Arizona Criminal Justice Commission

Statistical Analysis Center Publication

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Crime Mapping in Arizona Report

2002

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS 3

EXECUTIVE SUMMARY 5

FINDINGS 6
RECOMMENDATIONS 7
CONCLUSIONS 7

INTRODUCTION 9

CRIME MAPPING CONCEPTS 10

Manual Pin Mapping 11
Computer Mapping 11
Geographic Information System (GIS) 11
Geocoding 11
Crime Analysis 12

RESEARCH PURPOSE 12

RESEARCH METHODOLOGY 13

FINDINGS 14

SURVEY RESULTS 14

Internet Use & Crime Analysis Units 15
Who Uses Crime Mapping 16
Types of Crime Mapping Analysis 17
Software Uses 18
Usefulness of Crime Mapping 19
Base Map Sources 20
Data Quality 20
Training 21
Regional Analysis Center 23

CASE STUDIES 24

PRACTICAL APPLICATIONS 24

Mesa/Tempe Police Departments 24
Glendale Police Department 26
Arizona Criminal Justice Commission 29
Baltimore-Washington Regional Crime Analysis GIS (RCAGIS) 31

Kansas City Regional Crime Analysis GIS (KCRCAGIS) 33

ARIZONA CRIME MAPPING PROJECTS 34

Arizona Association of Crime Analysts (AACA) 34
Tucson GIS Cooperative 34
Crime and Intelligence Analysis Certification Program 35
Regional Crime Prevention Strategy 36
Automated Tactical Analysis of Crime (ATAC) 36
Sex Crimes Analysis Network (SCAN), Arizona Department of Public Safety 37
Arizona Department of Public Safety (AZDPS) 37
Arizona State Cartographer's Office 38

SPECIAL INVESTIGATION 40

ARIZONA REGIONAL ANALYSIS CENTER 40

Identification of Stakeholders 40
Scope 40
Data 41
Data Transfer 41
Location and Governance 42
Resources 42

MARICOPA REGIONAL ANALYSIS CENTER 43

RECOMMENDATIONS 46

CONCLUSIONS 48

BIBLIOGRAPHY 50

APPENDICES A-D

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EXECUTIVE SUMMARY

In the past decade, the use of computer crime mapping has steadily risen as more and more criminal justice agencies have begun to realize the potential of Geographic Information Systems (GIS). Although there have been significant increases, it is important to note that the use of crime mapping technology is not yet widespread among criminal justice agencies. During the past year and with the establishment of Homeland Security, increased emphasis has been placed on the value of accurate and timely geo-spatial information for public safety and crime prevention strategies. In order to move forward with the goal of advancing crime mapping efforts, it is critical to first understand current trends within Arizona.

Therefore, it is the purpose of this report to assess the existing status of crime mapping in Arizona. From this "snapshot," an assessment regarding the needs of criminal justice agencies for the advancement of crime mapping in agencies and/or communities could then be made. Several strategies were employed in order to better assess crime mapping efforts in Arizona. First, a statewide survey based upon a national model conducted by the Crime Mapping Research Center was administered to criminal justice agencies statewide. Second, qualitative interviews were conducted with crime mapping experts in the field with contributions of practical crime mapping applications included in this report. Additionally, based upon feedback from this research, the scope of the research project was broadened to include a study of a GIS based regional analysis center.

As the importance of mapping across jurisdictions becomes more apparent, criminal justice agencies throughout the country are recognizing the value of a regional analysis center. This was found to be true in Arizona with most agencies (95.2 percent) reporting an interest in contributing data to a state or regional analysis center.

At present, there are only a few criminal justice agencies (14.5 percent) that perform crime mapping within their department. Furthermore, the average length of time that agencies report having had crime mapping capabilities is approximately 4.5 years. This is actually longer than was found nationally (3.3 years) and would strongly indicate that the potential of mapping in criminal justice systems is in its infancy.

One of the major barriers to the advancement of crime mapping relates to the complexity associated with the implementation of a geographic information system. The successful mapping of crime data relies upon accurate information from both criminal and non-criminal justice agencies. In order to successfully map information there must be accurate crime event information (addresses) as well as street files that serve as base maps. Beyond these issues, criminal justice agencies report that inadequate resources and available training are the primary barriers for moving forward.

FINDINGS

This research project produced several notable findings. In particular, Arizona's crime mapping evaluation found:

- More than 93 percent of the respondents to the 2002 ACJC Crime Mapping Survey indicated their department had access to the Internet. Additionally, approximately 60 percent of these agencies reported that their department has an active web site.

- At present, there are only 21 criminal justice agencies (14.5 percent) reporting the use of computerized crime mapping. When looking at law enforcement agencies exclusively, this percentage goes up only slightly (16.5 percent).

- For the purpose of crime mapping, the software package with the greatest number of users is ESRI (Arc View or Arc Info) at over 80 percent.

- More than 80 percent of the agencies currently performing crime mapping in Arizona report using base maps from local government agencies to perform geocoding.

- Geocoding uses the street center line files for crime mapping. All but one of the responding agencies (95.2 percent) indicated their department used street center line files for geocoding purposes.

- More than 95 percent of Arizona criminal justice agencies reported an interest in contributing GIS information to a state or regional analysis center.

RECOMMENDATIONS

An important part of this research included the identification of recommendations designed to facilitate the continued progress of crime mapping in Arizona. The following are recommendations from this research:

- More resources dedicated to the advancement of crime mapping at the local level.
- Establish statewide standards pertaining to geographic information consistent with federal standards.
- Develop a Strategic Plan for the state of Arizona to assure that efforts for the sharing of geo-spatial are coordinated.
- Encourage the development of data quality standards regarding critical geographic information (addresses) at the local/agency level.
- Select a Committee to help evaluate options and make recommendations for creating a regional analysis center in Arizona.
- Pilot a Regional Analysis Center project in one or more urban counties.

The above recommendations were developed as a result of the evaluation conducted by the Arizona Criminal Justice Commission's Statistical Analysis Center pertaining to crime mapping. It is hoped that the above recommendations will assist policy and decision makers in setting the direction to further the crime mapping and geospatial data sharing projects in Arizona.

CONCLUSIONS

Although the use of geographic information systems has had widespread use for managing geographic and spatial data for decades, this technology has only recently begun to emerge within the criminal justice community. The tragic events of September 11, 2001, not only confirmed the need for greater coordination between agencies, this event also identified a need to obtain and maintain accurate spatial information on a local, state and federal level.

During this past year, substantial efforts have been directed toward the improvement of geographic information systems at all levels of government. An increased emphasis towards the development of accurate geographic information systems is paralleled with related funded opportunities. Therefore, a window of opportunity exists for the

development of an infrastructure to support a geographic information system in Arizona.

Effective crime mapping systems depend on accurate and timely information from criminal and non-criminal justice agencies. This information is combined to create data reflective of various community components and is essential in developing effective prevention, investigation, emergency response and planning initiatives. Although on the rise, crime mapping in Arizona is not being used to its greatest potential. In the upcoming years there exists a great opportunity to significantly improve geographic information systems in the Arizona criminal justice system. An improved information system based upon geo-spatial data would greatly assist decision makers with the difficult decisions associated with the allocation of limited resources.

INTRODUCTION

Computer mapping through the use of geographic information system (GIS) technology has been used to solve spatial and geographic problems for nearly forty years, but it has only recently begun to emerge as a significant tool in crime and justice. Until a decade ago, few criminal justice agencies could create computerized crime maps to examine the spatial distribution of crime activity in communities. In recent years, the use of computer crime mapping has increased among criminal justice professionals, but it is still not widely used within the criminal justice community.

With the tragic events of September 11th, 2001, the potential for geographic information systems within the criminal justice community has increased significantly. Information vital to Homeland Security is often based upon a geographic information system allowing for immediate and precise response with greater information at the local level. The increased emphasis on the development of accurate systems for the purpose of Homeland Security may provide opportunities for more resources in developing an infrastructure for the use of geo-spatial data within the criminal justice community. According to Mark Foreman from the Federal Office of Management and Budget, "states advancing integrated architectures would be looked upon more favorably for federal homeland security funding" (2002). Certainly, jurisdictions that have a coordinated strategic plan in place and can demonstrate an organized coalition will be in a better position to compete for limited monies allocated for crime mapping.

The purpose of this report is to assess the current state of crime mapping in Arizona. This report could also serve as a resource for future policy decisions on the issue of crime mapping. The findings from this assessment provide information regarding the number of criminal justice agencies currently using crime mapping tools in Arizona, the frequency in which they use the technology and how they apply it to combat crime within their jurisdictions.

The primary objective of this research was to conduct a survey of criminal justice agencies to determine the extent that crime mapping systems are used in Arizona. Additionally, a special investigation and initial assessment regarding an Arizona regional analysis center using geo-spatial data was conducted. It is hoped that the findings and recommendations of this report will assist decision makers in setting the direction for crime mapping policy for Arizona during a critical period in our country.

BACKGROUND

As the use of crime mapping systems increases, many law enforcement agencies are now realizing that the benefit of crime mapping extends beyond the ability to access accurate crime data. Criminal justice agencies that use crime mapping systems often combine their crime data with census data, city planning data, property assessment data, and utilities information to not only develop effective crime prevention strategies, but to also consider the "spatial relationships between crime and other community-level characteristics" (Crime Mapping Research Center, 1999).

Despite the benefits of computerized crime mapping, agencies that use this technology are beginning to recognize that mapping systems are only as valuable as the information (data) contained within them. Consequently, agencies that exclusively map their own data have a limited perspective of actual criminal activity because they are unable to visualize crimes that occur on their borders or in neighboring areas (La Vigne & Wartell, 2001). In response to this limitation, many jurisdictions are now implementing regional analysis centers.

A regional analysis center allows agencies within a similar geographic area to conduct the computerized mapping necessary to identify crimes occurring along or across jurisdictional boundaries. In fact, crime knows no jurisdictional boundaries — public safety and law enforcement agencies often fail to acknowledge this reality. Given the high mobility of crime in today's society the sharing of data through a regional analysis center is increasing in popularity. (Lutz, 2002). Additionally, a strong indicator of crime can be found through social and income disparities. A GIS regional analysis center or network provides a "visualization of databases offering a means to readily determine the relevancy of social trends and criminal developments; applied on a regional scale, the potential is rather staggering" (Lutz, 2002). Specifically a regional analysis center would allow for the assessment of large geographic areas using multiple sources of information for the purpose of planning and intervention strategies.

With the use of crime mapping systems on the rise among criminal justice agencies, researchers and practitioners now want to know how widely this technology is used within the criminal justice community. Crime mapping is complex and as such represents the first barrier in advancing the concept and importance of a geographic information system.

CRIME MAPPING CONCEPTS

In order to provide a framework for understanding the scope and purpose of this research, definitions related to crime mapping and crime analysis have been provided. A more comprehensive crime mapping glossary has been included at the end of this report.

Manual Pin Mapping

Pin mapping has been used in the United States by law enforcement agencies since the early 1900s and consists of a jurisdiction map with push pins indicating the location of a certain offense. Although manual pin maps represent one technique to visually display multiple crimes, they have several limitations. "Wall maps offer limited utility because they are difficult to keep updated and accurate, are difficult to read, and can display only a limited amount of data" (Crime Mapping & Analysis Program, 2002). The most significant limitation of manual pin mapping is the static information it provides.

Computer Mapping

The inability to query manual pin maps eventually led to the development of computer mapping. Computer mapping began to gain recognition as early as the mid-1980s, but it was not until the 1990s with the advent of powerful desktop computers that the use of computer mapping among law enforcement agencies began to gain popularity. Computer maps provide visual data, including information about different areas and places, which can be viewed at a glance. More importantly, computer mapping allows crime data to be stored, retrieved, manipulated and compared to other demographic variables, thus providing a more informative and effective tool for analyzing crime.

Geographic Information System (GIS)

A geographic information system (GIS) is a computer-based tool used for mapping and analyzing the relationships between people, things and events. GIS technology integrates query and statistical analysis with the visualization and geographic benefits offered by maps. A geographic information system (GIS) allows the user to create anything from a simple pin map to a three-dimensional visualization of spatial or temporal data. GIS differs from manual pin and computer mapping in that it allows the analyst to manipulate data and maps by combining various features to perform statistical functions. These abilities distinguish GIS from other information systems and make it more valuable to a wide range of public and private enterprises for explaining events, predicting outcomes and planning strategies. More importantly, the benefits of GIS technology are increasingly being used by criminal justice agencies to effectively respond to criminal activities and other criminal justice-related issues. Some of the different types of GIS software programs are: ArcView, MapInfo, GeoMedia, Atlas GIS and Mapitude.

Geocoding

Geocoding is the process by which tabular data such as crime information about arrests, calls for service, motives, etc., can be assigned to a location on the earth's surface to provide a visual representation for spatial analysis through mapping. For the most part, the law enforcement community uses crime event addresses as the geographic unit to which tabular data is gecoded. (The Crime Mapping Laboratory Police Foundation, 2000). Through the process of geocoding, crime event addresses are compared to a street center line (base map) file in order to establish the X and Y coordinates. Simply, X and Y coordinates can then be placed on a map for a visual

representation of the data. Therefore, it is critically important to crime mapping that there is an available street center line file readily available for the region that is to be analyzed. This process often necessitates the sharing of information between non-criminal justice entities and criminal justice agencies in order to successfully create crime maps.

Crime Analysis

The Arizona Association of Crime Analysts recognizes three primary categories of crime analysis: administrative, strategic and tactical.

- *Administrative Crime Analysis* is used to produce data involving economic, geographic and law enforcement information for long-range projects. Information produced for administrative crime analysis assists in financial, organizational, political and legislative planning and is critical to issues involving personnel, public information, and the law.
- *Strategic Crime Analysis* is used to solve ongoing problems through the assessment of operational strategies. The information received through strategic crime analysis is used for resource allocation such as scheduling patrol officers and determining beat configurations. Strategic crime analysis is also used to identify crimes occurring at differing times of the year, provide more effective and efficient police services to the community, and to disrupt, reduce or eradicate various crime problems.
- *Tactical Crime Analysis* is used to respond to immediate crime activities through the identification of trends and patterns. Tactical crime analysis establishes a link between the offender and the modus operandi information from a number of cases, which in turn assists law enforcement with investigations, crime solving, and the clearing of cases after a suspect has been apprehended (http://aaofca.tripod.com).

As previously noted, the complexity and understanding of geographic information systems are often the first challenges to be overcome in obtaining meaningful solutions for barriers preventing the advancement of crime mapping strategies. It was the goal of this section to serve as a foundation for later discussions in this report.

RESEARCH PURPOSE

This research project was funded by a grant awarded through the Bureau of Justice Statistics. The purpose of this research is to assess the current status of crime mapping within Arizona and to determine what needs criminal justice agencies may have to advance crime mapping in agencies and/or communities. The information obtained through this research will provide the basis for recommendations to the Commission for potential policy decisions pertaining to the overall advancement of crime mapping efforts in Arizona.

RESEARCH METHODOLOGY

The Statistical Analysis Center employed several strategies in conducting the research for the review and assessment of crime mapping in Arizona. The following discussion outlines the methods used for this research.

First, in order to better understand how crime mapping was being used in Arizona, the Arizona Criminal Justice Commission's Statistical Analysis Center conducted a statewide survey involving 154 criminal justice agencies over a six-month time period in 2002.

The Statistical Analysis Center's 2002 Crime Mapping survey was modeled after a study conducted in 1999 by the Crime Mapping Research Center (CMRC) of the National Institute of Justice (NIJ), and was supplemented by questions developed by subject matter experts who work extensively with computer crime mapping systems and GIS technology in Arizona. As a result, a 34-question survey was distributed to criminal justice agencies throughout the state, and was specifically designed to gather information about individual agency crime mapping capabilities in Arizona. (Appendix A).

The Statistical Analysis Center conducted interviews with crime analysts from the Arizona Association of Crime Analysts, reviewed initial survey results, and searched the Internet for the purpose of identifying agencies, programs, and projects highlighting critical issues relevant to the current status of Arizona crime mapping. Additionally, the Statistical Analysis Center included examples of practical applications of crime mapping in Arizona.

Through feedback received from subject matter experts in the field of crime mapping, the Statistical Analysis Center also included an initial study and assessment of a regional analysis center based upon geographic information within Arizona. Specifically, the Statistical Analysis Center staff analyzed national trends regarding regional analysis centers and specific elements that are critical in the successful implementation of a regional analysis center.

FINDINGS

SURVEY RESULTS

Due to the fact that the survey is based on a national survey, several questions allowed for comparisons between Arizona and the rest of the country. In order to analyze the data collected from these surveys, all data was entered into an SPSS database. This section provides a general review regarding results of the Arizona survey.

As noted previously, a national survey conducted by the National Institute of Justice to analyze crime mapping trends in law enforcement was used as a foundation for the Arizona Crime Mapping Survey. It is important to note this survey focused entirely on law enforcement agencies. In that over 75 percent of the Arizona Crime Mapping Survey was comprised of law enforcement agencies, a general comparison was deemed appropriate for this analysis. Therefore, when available, comparisons are made between the Arizona Crime Mapping Survey and the national survey conducted by the Crime Mapping Research Center of the National Institute of Justice.

The Crime Mapping Research Center survey was administered between 1997 and 1998 to a sample of 2,768 law enforcement agencies. Approximately, 72 percent of these surveys were completed and returned to be included in the National Institute of Justice 1999 publication, *The Use of Computerized Crime Mapping by Law Enforcement: Survey Results.* (Mamalian, 1999).

SURVEY RETURNED (NATIONAL SURVEY)		
	Number	**Percentage**
Yes	**2004**	**72.3**
No	**764**	**27.7**
TOTAL	**2768**	**100**

The Arizona survey sampled 154 law enforcement, attorney and probation agencies, and received responses from 145 agencies (94.2 percent). Specifically, the responding agencies included 109 law enforcement agencies, 14 county attorneys and 22 probation departments. Only nine agencies did not respond to the survey.

SURVEY RETURNED (ARIZONA)		
	Number	**Percentage**
Yes	**145**	**94.2**
No	**9**	**5.8**
TOTAL	**154**	**100**

Internet Use & Crime Analysis Units

In addition to questions related to crime mapping, criminal justice agencies were asked questions related to their access and use of the Internet. Currently, a large number of agencies (93.5 percent) use the Internet, whereas only 6.5 percent report not having access to email or the World Wide Web.

DEPARTMENT USE INTERNET (E-MAIL OR WORLD WIDE WEB)		
	Number	Percentage
YES	129	93.5
NO	9	6.5
TOTAL	138	100

Of those departments that use the Internet, approximately 60 percent also reported having an active web site (Appendix B).

ACTIVE WEB SITE		
	Number	Percentage
YES	81	60.4
NO	53	39.6
TOTAL	134	100

Although 81 agencies reported having an active website, 87.8 percent of the respondents indicated they were not currently linking to crime maps that are available through the Internet.

In addition, although most departments reported having the ability to produce computerized crime reports (73.4 percent), only a small number (16.7 percent) of respondents reported having a crime analysis unit within their department. This percentage increased slightly to 19.4 percent among law enforcement agencies exclusively.

Crime Analysis Unit (Law Enforcement Only)		
	Number	Percentage
YES	20	19.4
NO	83	80.6
TOTAL	103	100

The survey did glean some interesting information by demonstrating that criminal justice agencies are utilizing the power of the computer to generate various types of

crime reports. When asked, "what type of information can your agency access via the computer," 82.6 percent reported accessing Computer Aided Dispatch Records; 88.8 percent indicated they access Records Management Data for Reported Crimes; and another 86.7 percent reported accessing Records Management Data for Criminal Persons.

Although a high percentage of responding criminal justice agencies reported accessing various types of data for a myriad of reasons, when asked "which types of crime analysis does your agency currently perform," the numbers dropped dramatically and indicate that few agencies are conducting: Point Pattern Analysis (11.8 percent); Case Studies (16.8 percent); Linkage Analysis (8.6 percent); and Pattern Detection (17.9 percent). Not surprisingly, agencies reported accessing statistical reports and UCR data at much higher rates, 67.8 percent and 66.1 percent respectively.

Who Uses Crime Mapping

Similar to national findings (13 percent), only 14.5 percent of responding Arizona criminal justice agencies indicated that their department engaged in some level of computerized mapping. Of the 21 agencies that reported using computerized mapping, law enforcement agencies represented 86 percent (18 agencies) of this total.

COMPUTERIZED CRIME MAPPING		
	Number	Percentage
YES	21	14.5
NO	124	85.5
TOTAL	145	100

When considering law enforcement agencies exclusively, the overall percentage of departments participating in computerized crime mapping is 16.5 percent, which is only slightly higher than all criminal justice agencies (14.7 percent). This suggests that only a small percentage of law enforcement agencies currently use computerized crime mapping within their department.

COMPUTERIZED CRIME MAPPING (LAW ENFORCEMENT)		
	Number	Percentage
YES	18	16.5
NO	91	83.5
TOTAL	109	100

Of the criminal justice agencies that currently use computerized crime mapping, the average length of time that this technology has been used within their department is 4.5 years, which is slightly higher than the national average (3.3 years).

Types of Crime Mapping Analysis

A significant number of respondents indicated that their agency mapped offense data (86 percent), calls-for-service data (67 percent) and vehicle recovery (67 percent) data. Table 1 summarizes the offense and crime information and provides data for a national comparison.

Table 1: Crime Mapping Analysis

TYPES OF CRIME ANALYSIS					
	OFFENSE (ARREST)	**CALLS FOR SERVICE**	**VEHICLE RECOVERY**	**DRUG OFFENSES**	**LARCENY THEFT**
NATIONAL	91	65	52	50	69
ARIZONA	**86**	**67**	**67**	**55**	**75**

Criminal justice agencies in Arizona also geocoded and mapped larceny theft (75 percent), drug offenses (55 percent), as well as the UCR Part I Crimes: burglary (95 percent), vehicle theft (90 percent), robbery (85 percent), rape (85 percent), homicide (75 percent), aggravated assault (65 percent) and arson (70 percent). Table 2 summarizes the UCR Part I Crimes information and provides data for a national comparison

Table 2: UCR Part I Crime Analysis

UCR PART I CRIMES							
	BURGLARY	**VEHICLE THEFT**	**ROBBERY**	**RAPE**	**HOMICIDE**	**AGG. ASSAULT**	**ARSON**
NATIONAL	95	87	86	71	69	62	40
ARIZONA	**95**	**90**	**85**	**85**	**75**	**65**	**70**

Findings from the Arizona survey also paralleled the findings of the national survey in the area of mapping applications. Automated pin maps, an electronic form of the traditional wall map with push-pins, were reported to be used by approximately 71 percent of responding departments, whereas 72 percent of responding agencies reported using automated pin maps on a national level.

In addition, Arizona respondents reported the use of hot spot analyses at a slightly higher rate (86 percent) than on a national level (77 percent). Table 3 represents a summary of criminal justice agencies in Arizona that conduct hot spot analysis. Of the criminal justice agencies conducting hot spot analysis, 78 percent visually identify hot spots and 59 percent use computer programs to identify hot spots.

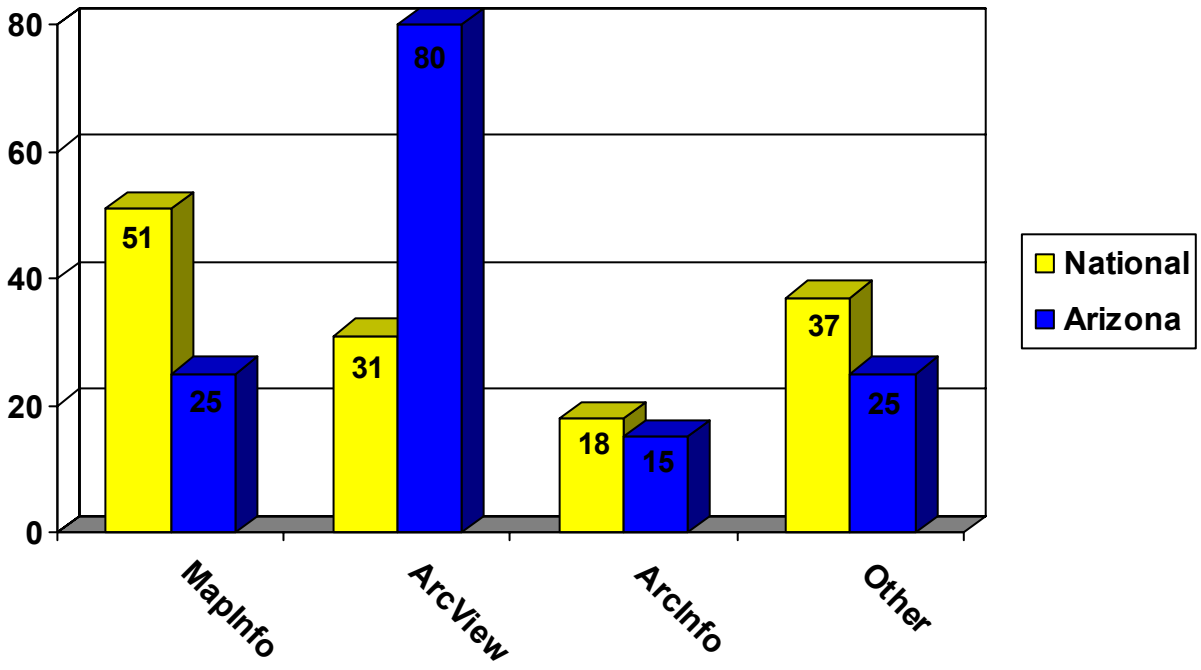
Table 3: Hot Spot Analysis

HOT SPOT ANALYSIS			
	PERFORM HOT SPOT ANALYSIS	**VISUAL IDENTIFICATION**	**COMPUTER IDENTIFICATION**
NATIONAL	77	86	25
ARIZONA	**86**	**78**	**59**

Software Uses

Significant differences between crime mapping trends in Arizona and national observations center on the types of software packages used. Chart 1 provides comparisons of the commercial mapping software used on a state and national level. In Arizona, crime analysts reported a higher use of ARCView software, while national trends reported a slightly higher usage of the MapInfo software. Specifically, 80 percent of criminal justice agencies in Arizona use ArcView, and a much smaller percentage of criminal justice agencies use MapInfo.

CHART 1: SOFTWARE COMPARISON



Criminal justice agencies were also asked what software their department primarily used for the purpose of crime mapping. Based on the responses to this question, it is clear that the field of crime mapping in Arizona is dominated by ESRI (Arc View & ArcInfo) products. Fifteen agencies (83.3 percent) reported that their department predominantly used an ESRI product.

SOFTWARE (ESRI OR MAPINFO)		
	Number	**Percentage**
ESRI	**15**	**83.3**
MapInfo	**3**	**16.7**
TOTAL	**18**	**100**

Usefulness of Crime Mapping

Agencies that use crime mapping systems reported significant improvements in the dissemination, evaluation and administration of criminal justice information. As seen in Table 3, Arizona agencies used crime mapping to inform officers (91 percent), evaluate interventions (52 percent), inform the community (76 percent), identify repeat calls for services (62 percent), and assist in resource allocation (62 percent). In addition, 95 percent of agencies in Arizona use crime mapping analysis to provide information to executives and command staff.

Table 4: Uses of Crime Mapping

USES OF CRIME MAPPING					
	INFORM OFFICERS	**INFORM COMMUNITY**	**EVALUATE INTERVENTIONS**	**IDENTIFY REPEAT CALLS FOR SERVICE**	**ASSSIST RESOURCE ALLOCATION**
NATIONAL	94	47	49	44	56
ARIZONA	**91**	**76**	**52**	**62**	**62**

Base Map Sources

One of the critical issues related to effective computerized crime mapping is the availability of an accurate base map to geocode addresses. In Arizona, most agencies (81 percent) acquired their base or street map from local non-criminal justice entities such as city planning agencies or departments of transportation. Only four agencies indicated that their agency developed the base map internally or purchased the product from an outside vendor.

BASE MAP FROM GOVERNMENT AGENCY		
	Number	Percentage
YES	17	81.0
NO	4	19.0
TOTAL	21	100

Currently, 95.2 percent of Arizona criminal justice agencies use street center line reference files for geocoding and crime mapping. These results are even higher than those found at the national level where 77 percent of law enforcement agencies reported using street center line files as a base map for geocoding.

BASE MAP USE STREET CENTER LINES		
	Number	Percentage
YES	20	95.2
NO	1	4.8
TOTAL	21	100

Data Quality

The quality of address data is critical for the purpose of crime mapping. Approximately 76 percent of the respondents currently participating in crime mapping programs indicate there is not a process for address verification in their records management system.

ADDRESS VERIFICATION		
	Number	Percentage
YES	16	23.8
NO	5	76.2
TOTAL	21	100

Training

Survey respondents also provided information regarding the training received by crime analysts. In Arizona, a significant number of crime analysts were self-taught with some informal training received by other crime analysts. Less than 10 percent of the respondents indicated that they had received GIS or crime mapping training via online educational sites. Despite the lack of formalized training via the Internet, respondents indicated a strong interest in attending courses for GIS and crime mapping if the courses were made available online. Supporting this finding, almost 60 percent of respondents indicated they would be "likely" or "very likely" to attend a class via the Internet. Furthermore, most departments (90.5 percent) reported a strong interest in attending a certified course in crime analysis or activity if it were offered in Arizona, but most agencies were unaware of the certified program in Crime and Intelligence Analysis currently available in Arizona.

Agencies that currently possess crime mapping capabilities were also asked to rate the skill set of the individual with the highest level of expertise in their department. Over 90 percent of the responding agencies indicated that their most experienced crime analyst possessed "average" or "above average" skills in the area of crime mapping. Additionally, over 60 percent of crime analysts rated their most skilled crime analyst as either "proficient" or "very proficient." Table 5 summarizes the information pertaining to the proficiency of crime analysts throughout the state.

Table 5: Proficiency of Crime Analysts

SKILL LEVEL			
NOT PROFICIENT	**AVERAGE**	**PROFICIENT**	**VERY PROFICIENT**
9.5	**28.6**	**28.6**	**33.3**

Similar to national findings, criminal justice agencies in Arizona identified financial resources (66.7 percent), training (31.5 percent) and personnel (39.6 percent) as significant barriers to improve crime analysis efforts throughout the state. Responding agencies were also asked to provide general feedback about crime mapping in Arizona. The responses from these questions also supported the barriers identified by agencies that perform crime mapping. Specifically, criminal justice agencies throughout Arizona identified adequate resources and training as essential needs in order to further the progress of crime mapping in Arizona.

Additionally, responding agencies provided the following feedback, comments and suggestions:

- *Criminal justice leaders (executives) need to be trained (informed) about the benefits of crime mapping through the use of Geographic Information System (GIS) technology.*

- *The Arizona Criminal Justice Commission (ACJC) should play an instrumental role in the development of a regional data sharing project.*

- *Crime mapping and GIS technology should be extended to the rural areas of Arizona where little resources are available.*

- *A central source of mapping (regional or state analysis center) would benefit the law enforcement community by improving statistical reporting and criminal investigations.*

- *In the future, crime mapping applications should focus on the mapping of gun and homicide information.*

- *Agencies need to secure funding that would allow analysts to attend crime mapping conferences.*

- *There needs to be increased coordination between juvenile probation and law enforcement for mapping purposes, and greater access to available court data.*

- *Valley agencies should seek state or federal grant funds to establish a data sharing system whereby crime data and modus operandi information could be easily and quickly shared across boundaries.*

It is evident from the feedback received from the ACJC Crime Mapping Survey that there is interest in the criminal justice community to expand the use of crime mapping in Arizona.

Regional Analysis Center

It is important to note that the previous discussion contained several specific suggestions from selected criminal justice agencies regarding the sharing of crime data between criminal justice agencies. One of the questions that emerged from our research revolved around the concept of a regional analysis center or state repository for geographic information in Arizona. The ACJC survey found that 95.2 percent of the respondents indicated a willingness to contribute data to a GIS state repository or regional analysis center. It is also important to note that the findings from the ACJC survey are very much in line with the qualitative interviews the Statistical Analysis Center staff conducted with criminal justice GIS groups and individuals in the field.

Agency Willing to Contribute Data To GIS Regional Analysis Center		
	Number	**Percentage**
YES	**120**	**95.2**
NO	**6**	**4.8**
TOTAL	**126**	**100**

Based upon the findings from our research there is substantial evidence that there is support from the criminal justice community for the concept of a GIS regional analysis center. The evidence certainly warrants further investigation and consideration for the development of a pilot regional analysis center in Arizona.

CASE STUDIES

PRACTICAL APPLICATIONS

Feedback was solicited from criminal justice agencies regarding examples of crime mapping efforts in Arizona. Based upon this solicitation, three examples were submitted and included for illustrative purposes. The first two examples are considerably more complicated and provide excellent examples of tactical crime analysis projects. The last example of an administrative analysis project uses Unified Crime Report Crime Index and Homicide data provided by the Department of Public Safety.

Mesa/Tempe Police Departments

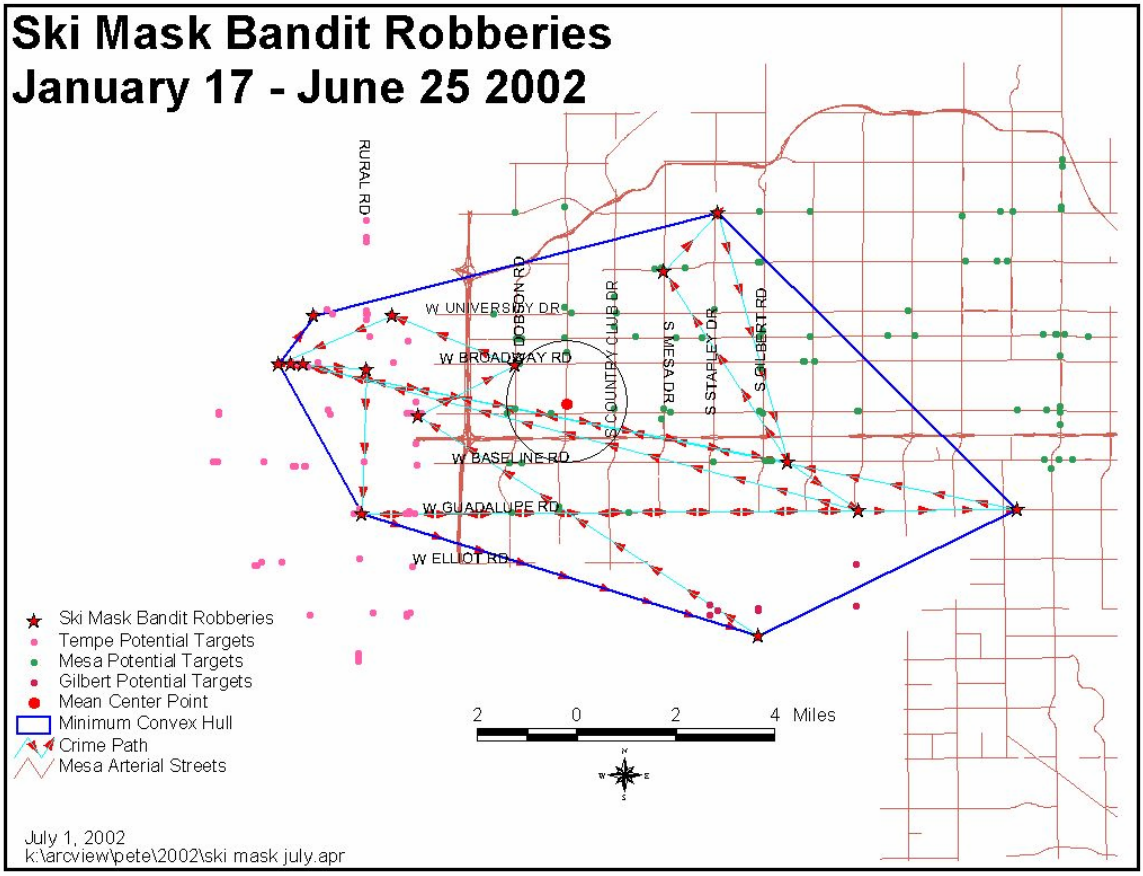
From January to July 2002, 20 robberies were committed in the cities of Mesa, Gilbert, and Tempe. Crime analysts from Mesa and Tempe Police Departments, Peter Garza and Eric Nelson, worked together to develop a predictive model based on the suspect's movement patterns, potential future targets, and cyclical spacing of incidents in order to determine when and where the suspect might strike again.

The suspect was identified as a white male who wore a black ski mask, dark clothing and black gloves. The "Ski Mask Bandit" usually entered fast food or strip mall establishments (i.e. pizza parlors or video stores) during evening and used a chrome (silver) semi-automatic handgun. The suspect typically ordered employees to the ground, disabled phones, and demanded money from the register and any drop safes at the establishment. Additionally, a late model SUV was observed at three of the target locations.

Through frequent conferences with the detectives, surveillance units, and patrol squads from Tempe, Mesa and Gilbert Police Departments, Garza and Nelson developed a predictive model, and the following information was analyzed: suspect's past actions, movement patterns, frequency and tempo of hits, location studies, victim (target) analysis, dollars-per-hit and other geographic and causal factors. Based on findings from the analysis, Garza and Nelson informed the involved departments of the predicted next strike date, time span, and locations developed by the analysis model.

Surveillance of those locations revealed the above mentioned investigative lead of a vehicle driving into the parking lots of three of the predicted locations on the predicted date between the predicted times, with the driver appearing to be "staking out" the businesses. Though contact with the vehicle was not initiated, the vehicle description gave detectives a follow-up lead. While the perpetrator has not been apprehended, the number of incidents has substantially decreased, through the coordinated efforts of the three departments. Analysts Garza and Nelson continue to confer, meeting regularly

with analysts and detectives from other Valley agencies to update this robbery series to discuss and recommend further steps to assist in the dissolution of this activity.



Glendale Police Department

Bryan Hill, crime analyst for the Glendale Police Department has an extensive history in the field of crime mapping and geographic information systems and has received national recognition for his work. He has presented at numerous conferences on a variety of crime mapping and GIS subjects, and is a certified instructor for the Environmental Research Systems Institute (ESRI) Authorized Teaching Program.

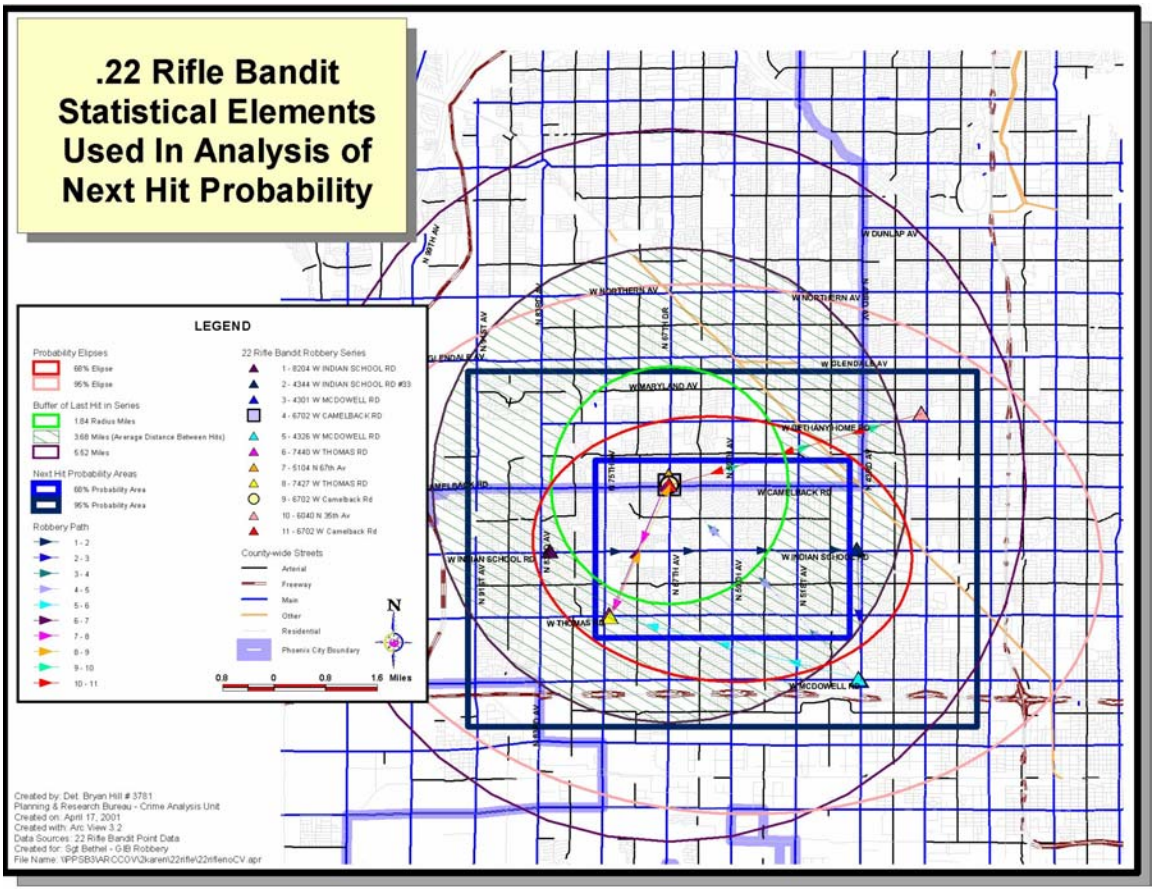
To date, one of Hill's most significant accomplishments is the development of the Probability Grid Method (PGM). The PGM is a crime mapping technique designed to predict the next hit in a series of crimes. Instead of relying on one spatial statistical model to predict the next hit in a crime series, the PGM incorporates all the common methods used by analysts to make predictions. Specifically, the analyst records what elements are found within each grid that is laid out across an electronic map. If the standard deviation ellipse or rectangle crosses the grid, it gets a score of 1, if it doesn't it gets a score of 0. Measurements of distance, direction and frequency are also taken from the offender's behavior and scored for each grid. A cumulative score is then assigned to each grid based on these individual scores, and the probability grid is graphically displayed on the map.

The decision-making assistance this method offers serves as a benefit through capitalizing on the investigator's experience as well as incorporating statistical methods and data. The crime analyst can improve the prediction and reduce the number of targets using PGM. A combination of several simple geographic criteria, that include standard spatial statistics and general geographic relationships, provides a more operationally useful product to investigators. Since the development of the Probability Grid Method, Hill has successfully employed this strategy on several cases. The following are two cases that are being highlighted to demonstrate the strategy and as examples of tactical crime analyses.

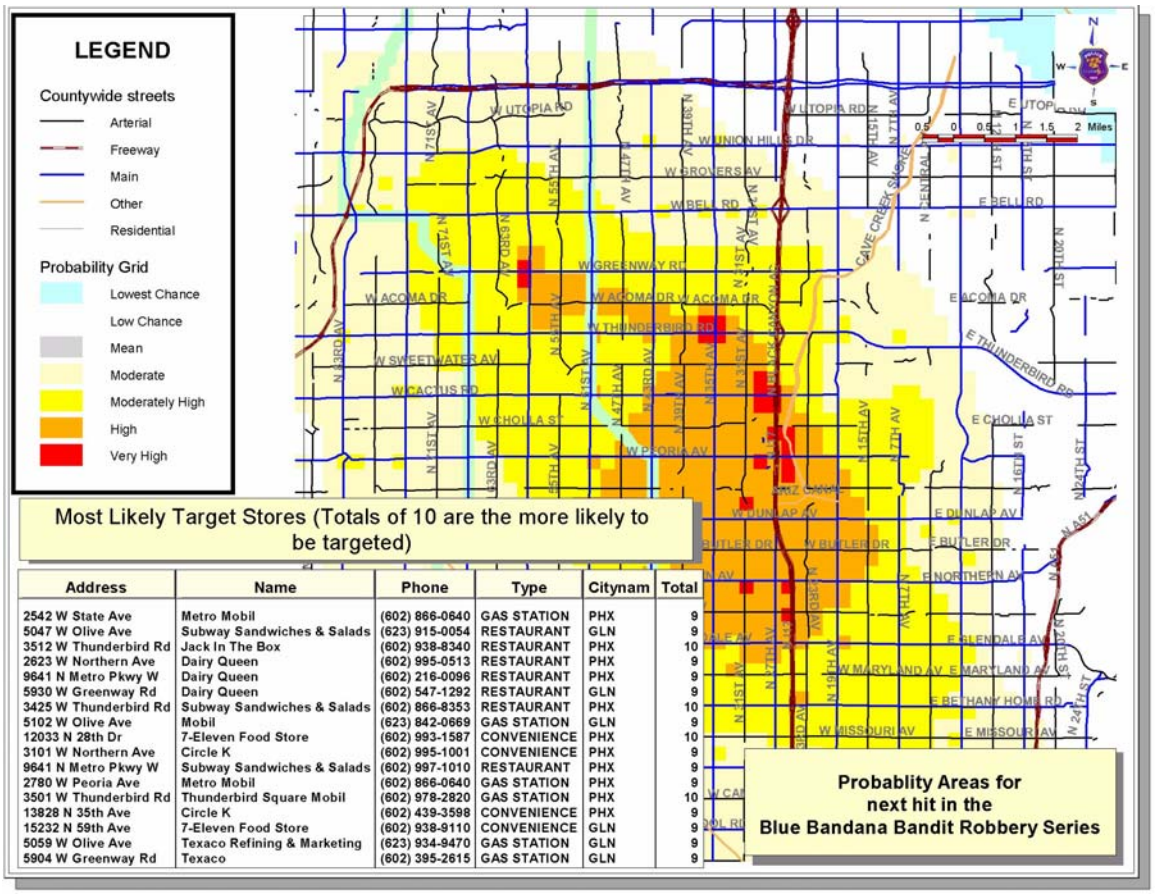
The first example involved the case of the "Video Bandit" (also referred to as the .22 Rifle Bandit). In the Video Bandit series, there were a total of 11 robberies and one homicide in April 2001. The only other information available was that the suspect was a White or Hispanic male, and in several cases he was seen leaving the area in a red Saturn-type vehicle. The PGM analysis process correctly identified the location of the last hit in the series; however, the offender has not been apprehended due to issues regarding cross jurisdictional information sharing.

At this point, an alternative method known as Journey To Crime identified not only the probable areas of the suspect's residence, but thorough searches of databases identified the suspect himself for detectives in the "Video Bandit" robbery and homicide series. Several hundred possible offenders were initially identified through database searches of those individuals seen in or with a red Saturn vehicle. The JTC analysis whittled this total down to 54, and one name was listed in at least three different data sources. The suspect was a probationer that had an outstanding probation violation

warrant for his arrest. On April 15th, the probationer was subsequently arrested and a search warrant served. From the search, evidence of the crimes was obtained and he is now serving his sentence for the robberies and murder.



Another example of the PGM process being employed was a 2001 robbery crime series dubbed the "Blue Bandana Robber." The offender had hit approximately ten times within the City of Glendale, Arizona between March 19th and April 11th 2001. On the date and time predicted in the analysis, the suspect showed up at 59th Avenue and Greenway Road and attempted to rob the store while undercover units watched. The offender was also recognized by the clerk who had been robbed several times and he fled the scene. Before he left the scene however, his license plate number was obtained and units proceeded to his home to wait for him. The offender then went home and was met by police officers and was subsequently arrested. Evidence of his robberies was retrieved and this offender has recently pled guilty to 7 counts of armed robbery. He indicated during his interview that drug addiction was the motivation for the robberies.



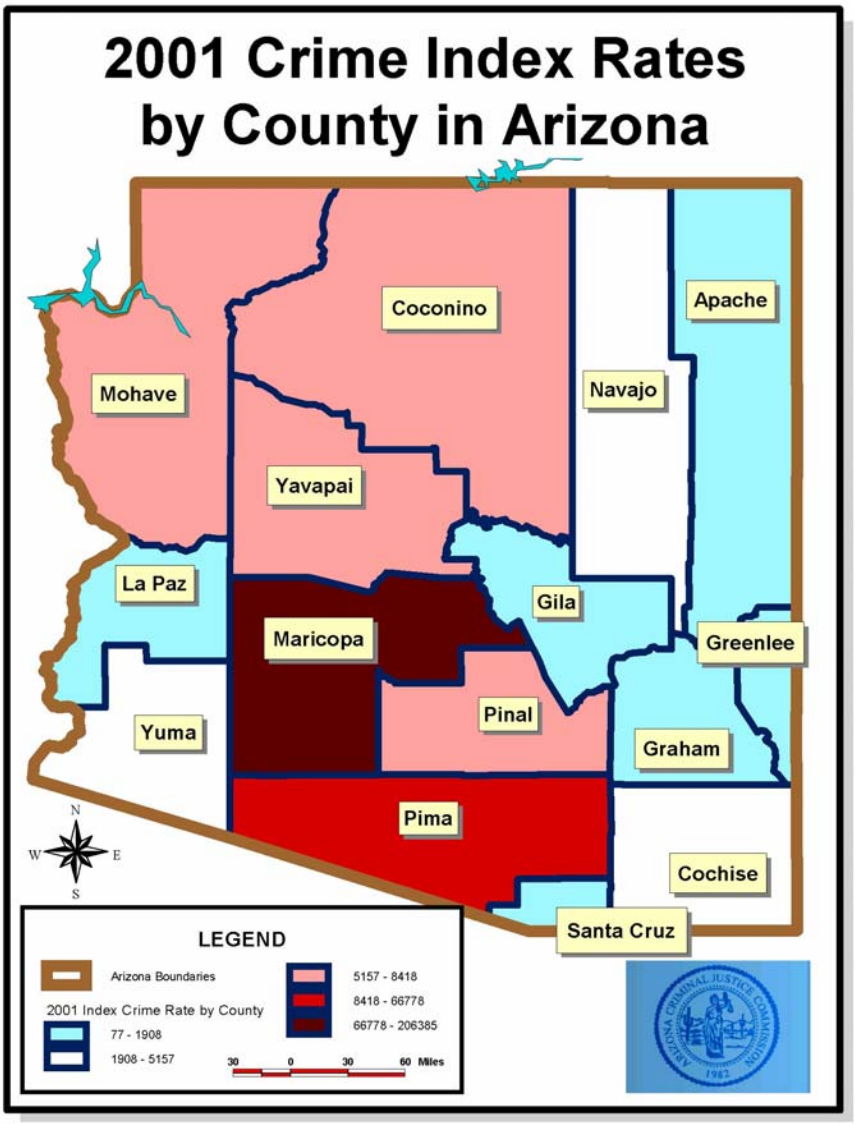
Address	Name	Phone	Type	Citynam	Total
2542 W State Ave	Metro Mobil	(602) 866-0640	GAS STATION	PHX	9
5047 W Olive Ave	Subway Sandwiches & Salads	(623) 915-0054	RESTAURANT	GLN	9
3512 W Thunderbird Rd	Jack In The Box	(602) 938-8340	RESTAURANT	PHX	10
2623 W Northern Ave	Dairy Queen	(602) 995-0513	RESTAURANT	PHX	9
9641 N Metro Pkwy W	Dairy Queen	(602) 216-0096	RESTAURANT	PHX	9
5930 W Greenway Rd	Dairy Queen	(602) 547-1292	RESTAURANT	GLN	9
3425 W Thunderbird Rd	Subway Sandwiches & Salads	(602) 866-8353	RESTAURANT	PHX	10
5102 W Olive Ave	Mobil	(623) 842-0669	GAS STATION	GLN	9
12033 N 28th Dr	7-Eleven Food Store	(602) 993-1587	CONVENIENCE	PHX	10
3101 W Northern Ave	Circle K	(602) 995-1001	CONVENIENCE	PHX	9
9641 N Metro Pkwy W	Subway Sandwiches & Salads	(602) 997-1010	RESTAURANT	PHX	9
2780 W Peoria Ave	Metro Mobil	(602) 866-0640	GAS STATION	PHX	9
3501 W Thunderbird Rd	Thunderbird Square Mobil	(602) 978-2820	GAS STATION	PHX	10
13828 N 35th Ave	Circle K	(602) 439-3598	CONVENIENCE	PHX	9
15232 N 59th Ave	7-Eleven Food Store	(602) 938-9110	CONVENIENCE	GLN	9
5059 W Olive Ave	Texaco Refining & Marketing	(623) 934-9470	GAS STATION	GLN	9
5904 W Greenway Rd	Texaco	(602) 395-2615	GAS STATION	GLN	9

This research regarding the Probability Grid Method should improve the process and allow for a better overall prediction in the future of tactical crime analysis. Hill is currently working toward improving this technique so that it can be used as a reliable tactic by crime analysts everywhere. Hill's expertise and contributions have been invaluable to local law enforcement in Arizona, and have been instrumental in solving a variety of crimes throughout the state.

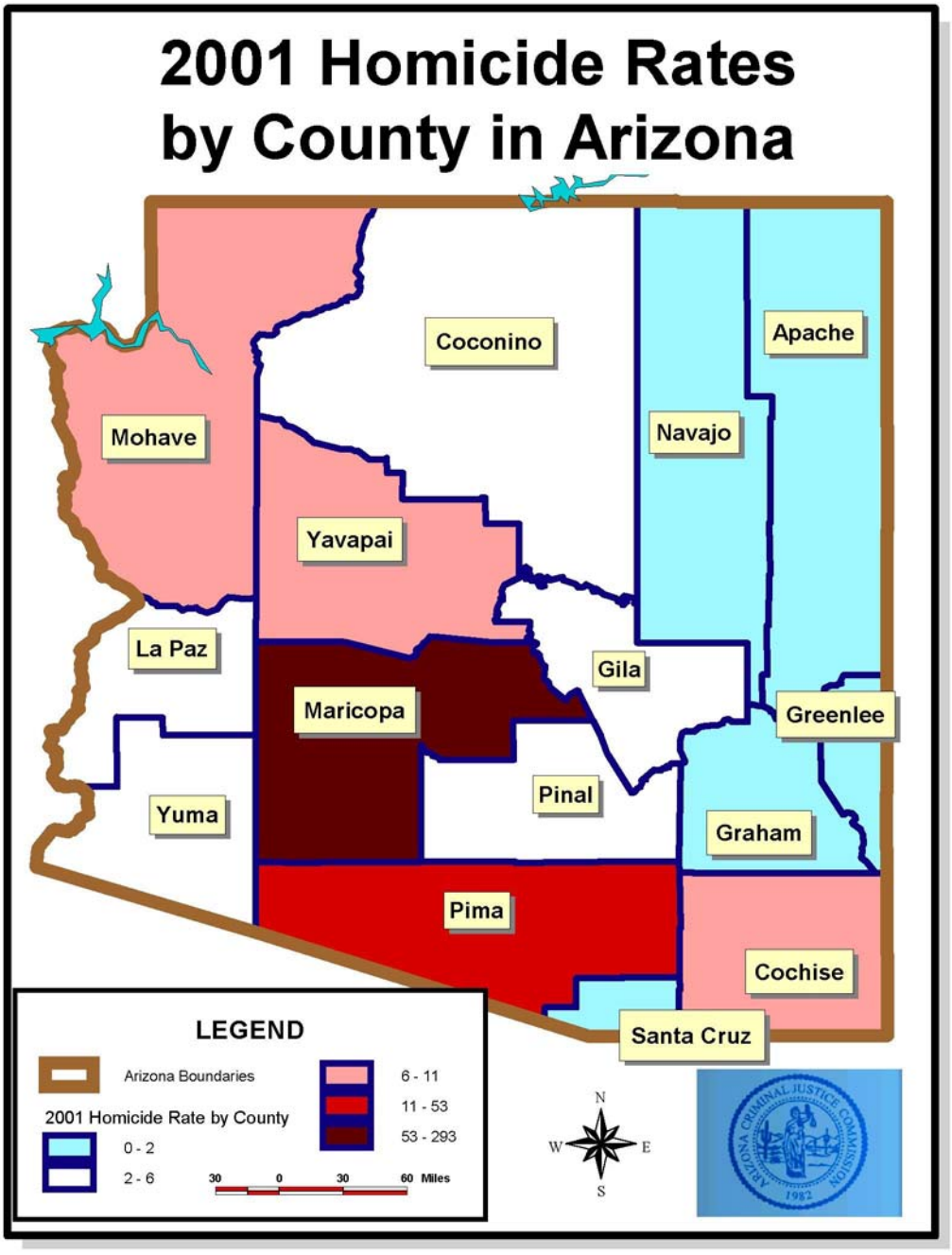
Arizona Criminal Justice Commission

The final two maps provide a visual representation for the crime index and homicide rates for each county in Arizona. The data was provided the Arizona Department of Public Safety from the Unified Crime Reports (UCR) they receive. The actual maps were produced by Bryan Hill from the Glendale Police Department. These are examples of administrative analysis using crime information displayed for each Arizona County. These maps could have been merged with census data to establish actual rates of crime based upon population. The maps do provide a visual representation as the number of crimes and homicides committed in Arizona.

The following map provides Crime Index counts for each of the counties within Arizona. As can be expected, Maricopa and Pima County have the highest number of crimes within their respective jurisdictions.



The following map indicates the Homicide Counts for Arizona by for each county. As can be expected, Maricopa and Pima County have the highest number of homicides within their respective jurisdictions.



REGIONAL ANALYSIS CENTER

As previously mentioned, an objective that evolved from our initial research was the concept of a regional analysis center to share data across jurisdictions. For this purpose, several regional analysis centers throughout the United States were contacted in order to provide an understanding as to what has already been done in this area. Two of these case studies were selected for presentation and further discussion. The Baltimore-Washington project (RACAGIS) was selected due to the long history and great success of the data sharing of geo-spatial information. Information presented on the Baltimore-Washington program was obtained from Mr. Phil Canter from the Baltimore Police Department. The second case study, the Kansas City Regional Crime Analysis GIS project (KCRAGIS), was selected due to the timeliness of the project and as a demonstration of the collaboration with the Crime Mapping Association Program (CMAP). The director of CMAP, Noah Fritz, provided information as to the current status of the KCRAGIS project. Additional case studies were reviewed and are available for further reading on the subject of regional analysis centers. (Appendix C).

Baltimore-Washington Regional Crime Analysis GIS (RCAGIS)

The Baltimore-Washington Regional Crime Analysis System (RCAS) was formed during the early 1990s. The purpose of RCAS was to create coding standards for the collection and distribution of tactical crime data from police departments serving the Washington-Baltimore metropolitan area. As a participating police member, an agency agrees under a Memorandum of Understanding to collect specific data on three tactical crimes: motor vehicle theft, burglary, and robbery. Member agencies also receive a copy of the Regional Crime Analysis Program (RCAP). The RCAP program allows a member agency to enter tactical crime data into a relational database comprised of five tables: main (situational-environmental-spatial-temporal data), vehicle (suspect and target vehicle), arrest (suspect history on individuals charged with committing a tactical crime), modus operandi, and property. The RCAP can be used to query and link incidents to a known offender history file, generate summary statistics and incident reports based on subsets created from a query, and export records for mapping and analysis.

Crime data maintained by participating agencies are electronically uploaded to a central server located at the Washington-Baltimore High Intensity Drug Trafficking (HIDTA) office. As a partner in RCAS, the WB-HIDTA maintains the RCAS file server. The RCAS files can be accessed on a secure line by a member agency, and appended to an agency's existing database for analysis. Recently, the WB-HIDTA and University of Maryland at College Park designed a new RCAS that operates within a virtual private network (VPN) environment. Member agencies can access and query regional crime data via the Intranet. The RCAS also created a listserve that allows participating agencies to send secure information to other member agencies.

In 1998, the US Department of Justice partnered with RCAS to develop a comprehensive crime mapping program. The RCAGIS (Regional Crime Analysis GIS) is a system designed to assist in the analysis of tactical crime incident data from Baltimore

City and the five surrounding counties of Anne Arundel, Baltimore, Carroll, Harford and Howard. Features of this system include: (1) three modes, each designed for a specific level of analysis (simple queries, crime analysis or reports); (2) wizard-driven incident database queries; (3) graphical tools for the creation, saving and printing of map layout files; (4) an interface with CrimeStat® spatial statistics developed by Ned Levine and Associates for advanced analysis tools such as hot spot surfaces and ellipses; (5) tools for graphically viewing and analyzing historical crime trends in specific areas; and (6) linkage tools for drawing connections between vehicle theft and recovery locations, incident locations and suspects' homes.

The structure of RCAGIS provides agencies with the ability to run the program locally through a distributed environment. Local agencies record crime incidents by entering data into either their own Records Management System (RMS) or the Regional Crime Analysis Program (RCAP). Agencies using their RMS for data entry then run programs to extract records in compliance with RCAP data standards. Data records are geocoded using either RCAGIS or an agency's in-house GIS. The RCAP data is subsequently uploaded to the High Intensity Drug Traffic Area (HIDTA) server. Agencies then download the entire region's data to their own networks and work on their own Local Area Network (LAN) for intra-agency sharing. (Mapping Across Boundaries, 2001). The structure of RCAGIS also enables the system to map any data assigned a geographic coordinate. In addition to mapping incident locations, RCAGIS also has the capability to link an incident address to the last known place of residence for an individual arrested for committing a crime, and to display the location of a recovered vehicle and link this recovery with the theft location. (Mapping Across Boundaries, 2001).

While the benefits of RCAGIS are extensive, several challenges emerged throughout the development and implementation of this system. Of these challenges, the most significant obstacles included: (1) agencies using different map projections; (2) the accuracy of agency uploaded information and (3) issues related to the privacy of agency information. In addition to these barriers, there were significant costs associated with the implementation of RCAGIS. The development of RCAGIS software, which required four full-time programmers for approximately 18-months represents the most significant cost of the system. It should be noted that the full-time programmers were provided in-kind by the US Department of Justice GIS Staff. Therefore, it is difficult to assign a specific value to these services had they been obtained through the private sector. The costs of the HIDTA server that houses the shared data cost approximately $25,000, the Regional Crime Analysis Program cost approximately $6,000 and each workstation using RCAGIS requires a $100 MapObjects run-time license. The RCAS Member agencies, through their $1,000 annual fee, receive free copies of RCAP and RCAGIS (for one workstation).

Kansas City Regional Crime Analysis GIS (KCRCAGIS)

The Kansas City Regional Crime Analysis GIS (KCRCAGIS) project was created to share regional crime and intelligence information between more than 85 criminal justice agencies across two states and 10 counties. Specifically, the regional analysis center was designed to track the geospatial relationships of deviant behavior and to offer crime and intelligence analysts the tools and information they need to counter crime and terrorist activity. KCRCAGIS utilizes the power of geographic information system (GIS) technology, combined with local data and the use of a virtual private network (VPN) to interactively display criminal activity across what historically were closed jurisdictional boundaries.

The significance of KCRCAGIS is that it extends crime analysis beyond the stationary display of criminal activity. For the first time, agencies in various jurisdictions have access to standardized information, and users have the ability to query this data to identify crime patterns. In addition, because geospatial information that was formerly not available now exists, this system enhances command decisions about threat assessments, target-hardening and crime prevention efforts. Information about public transportation networks, special events, terrorist-prone targets, hot spots, public housing, land use, known offenders (probationers, parolees and registered sex offenders) are contained within this secured system and can be shared (KCRCAGIS, 2002).

Once operational, local participants will use their existing records management systems to compile a standard set of data elements related to crime and criminal offenders. Participating agencies will then create an extractable computer file that contains crime activity for a predetermined period of time. This information will be subsequently sent to a VPN secured database hosted by the Midwest HIDTA where the crime and intelligence data will be geocoded.

The estimated cost to create and implement this project is about $750,000 for the first three years. Resources of the participating agencies and their dedicated staff have generated funding for this project. The University of Denver and the Environmental Sciences Research Institute (ESRI) have provided the hardware and software equipment. "Additional funding for the hardware and software updates and HIDTA migration supporting all agencies in the two-state area is currently being sought, as well as the need for on-going financial support for system maintenance and database management" (KCRCAGIS, 2002).

ARIZONA CRIME MAPPING PROJECTS

There are numerous projects and initiatives that have contributed greatly to the advancement of crime mapping techniques within Arizona. Our list is not meant to be exhaustive, but rather illustrative of the innovative programs that are influencing the direction of crime mapping in Arizona.

Also included at the end of this section are ongoing initiatives that could greatly impact the growth of crime mapping in the near future. Several agencies are attempting to coordinate efforts for the development of a statewide Strategic Plan that would include standards for geo-spatial information.

Arizona Association of Crime Analysts (AACA)

The Arizona Association of Crime Analysts (AACA) is a non-profit organization of law enforcement and criminal justice personnel working in crime and intelligence analysis in Arizona. The mission of the Arizona Association of Crime Analysts is to "establish and maintain a forum for advancing the utility and function of the crime analysis discipline through the exchange of ideas and information in an open, honest and professional manner" (www.aaofca.com). The association holds monthly meetings to share information on crime trends and series across the Valley and the state. The meetings also provide a forum for training, networking, and general information sharing between analysts from different agencies and jurisdictions. Currently, 28 agencies (Appendix D) participate in the association representing law enforcement, corrections and other criminal justice agencies across the state.

Tucson GIS Cooperative

Strong partnerships and collaborative efforts can best define the foundation upon which the Tucson GIS Cooperative was built. During the past three years, this organization has contributed significantly to the development and use of geographic information systems (GIS) capacity and return on investment in many areas of City government. The current chairperson is Donald Ijams from the Tucson Police Department Research and Analysis Section.

The Tucson GIS Cooperative is formed primarily from employees from the City of Tucson who possess expertise and interest in the use of geographic information systems (GIS). Until August 1999, the Tucson GIS Cooperative had been meeting regularly as a loosely formed GIS users group. The GIS Cooperative evolved from this users group when the need for a more formal structure became apparent through requests from City Government to move GIS forward.

The GIS Cooperative meets regularly, sponsors training, advises on GIS matters and exerts significant influence on the expenditure of centrally budgeted GIS funds.

Specifically, the GIS Cooperative has promoted GIS development within the City Information Technology Department, sponsored a city web-based information portal project using GIS called CityScan, supported city employee attendance at GIS conferences, purchased and deployed GIS software and maintained the City GIS web site. Further, the GIS cooperative has increased GIS training opportunities through the development of training curricula, direct delivery of training and securing funding for outside GIS training.

The GIS Cooperative looks forward to an enterprise-wide GIS capability, where the spatial aspects of data are fully integrated with mainline data processing and where seamless access to data by a wide variety of end users is enhanced through the use of GIS technology.

Crime and Intelligence Analysis Certification Program

Criminal justice agencies throughout Arizona have identified the need for qualified personnel to perform crime and intelligence analysis. In response to this need, the Maricopa Community College System, Phoenix Police Department, Mesa Police Department, Glendale Police Department, Tempe Police Department, Chandler Police Department and the Arizona Department of Public Safety (AZDPS) developed and implemented a Crime and Intelligence Analysis Certification Program. The certification program, which is only the second of its kind in the country, is comprised of six college-level courses which instruct students as to the various types of crime analysis; methods for gathering and analyzing crime data; and the use of crime statistics and Geographic Information Systems (GIS) to spatially present crime data and patterns.

The certification program was designed to equip individuals with both the knowledge base and skill set necessary for effective crime and intelligence analysis. In addition, the certification program seeks to improve the level and quality of analysis throughout the state. The courses are taught by experienced crime and intelligence practitioners who provide students with fundamental analysis skills through academic instruction and practical applications within a criminal justice environment. The certification program assists existing criminal justice and law enforcement employees as well as those who wish to pursue careers in such agencies. The first cohort was offered in January 2002, and due to the high level of interest another cohort will begin in August 2002.

The implementation of the certification program, and the high level of interest it has received statewide, reflects the increasing reliance upon crime and intelligence analysis in Arizona. As the focus on crime mapping and analysis increases within the criminal justice community, the need for qualified individuals to perform these functions will also increase. The certification program impacts the criminal justice system in Arizona by providing more highly qualified applicants to fill the variety of analysis positions that will be available throughout the state in the very near future. For additional information about this certification course, visit the Arizona Association of Crime Analysts webpage at www.aaofca.com.

Regional Crime Prevention Strategy

The Regional Crime Prevention Strategy (RCPS) is a collaborative effort between the Maricopa County Juvenile Probation, the Arizona Criminal Justice Commission (ACJC), the Arizona Department of Health Services (ADHS), and the Arizona Prevention Resource Center (APRC) for the purpose of crime prevention. The Maricopa Juvenile Probation Department has an extensive history of collecting critical information pertaining to juveniles through their Juvenile Online Tracking System (JOLTS) database. This project seeks to merge different geographical databases for the purpose of spatial analysis from a community and neighborhood perspective. The information that will be available through this project includes: (1) JOLTS data; (2) social indicator data; (3) demographic data; (4) program inventory data; and (5) information from the Arizona Youth Survey. In the future, additional data layers may be added to this information to further enhance the strategic and community analysis of juvenile crime.

Merging of this data will provide a regional or community profile of current conditions, problem areas, location of services, location and characteristics of youth involved with the Maricopa County Juvenile Probation Department, social indicators, youth and community risk and protective factors, and demographic information. The significance of the Regional Crime Prevention Strategy is that it provides the fundamental information needed to develop effective crime prevention alternatives. It is also hoped that the Regional Crime Prevention Strategy will serve as both a national and local model for other counties and jurisdictions.

Automated Tactical Analysis of Crime (ATAC)

The Automated Tactical Analysis of Crime (ATAC) Crime Pattern and Series Identification Software are designed to enhance and improve crime analysis among law enforcement agencies. ATAC is a user-friendly, fully adaptable crime analysis tool that was designed by professional, tactical crime analysts. This software program utilizes powerful search and query tools to provide crime analysts with instant access to any requested data. In addition to basic tactical analysis, ATAC has many advanced features including the Time Series module that performs most temporal analysis in seconds, and the Trend Manager which tracks up to 100 simultaneous trends, patterns and series. Without question, the most impressive feature of ATAC is the Trend Hunter. Trend Hunter is structured to find trends in data that the analyst may not even be aware exists. ATAC can also export and interact with most software programs including GIS programs such as ArcView and MapInfo along with mathematical programs such as SPSS, SAS, and MathSoft. The utility of ATAC has already extended to Arizona. Currently, ten police departments throughout the state use this software, and the use among law enforcement is expected to increase as more agencies realize the benefits of crime mapping. The cost of ATAC ranges from $2,500 for a single user to $10,000 for a site license.

Sex Crimes Analysis Network (SCAN), Arizona Department of Public Safety

In January 2002, the Arizona Attorney General's Office provided funding to the Arizona Department of Public Safety (DPS) to implement the Sex Crimes Analysis Network (SCAN). Funding for this project stemmed from an awareness that: (1) sex offenders often commit crimes in different jurisdictions; (2) scarce resources were often expended by one agency unaware that the offender had been arrested by another agency; and (3) serial offenders often escaped sentences as repeat offenders. Once operational, the Sex Crimes Analysis Network (SCAN) will improve law enforcement efforts by better coordinating the investigations of multi-jurisdictional serial sexual assault crimes in Arizona, and will increase the efficiency and effectiveness in identifying and apprehending serial sex offenders.

SCAN will use the existing, homicide-oriented ViCAP software to capture sex crime data. The ViCAP database is compatible with the Department of Public Safety database (DB2), and will accommodate the future programming and software needs of the department. In the future, the ViCAP system will be web enabled, which will allow any agency connected to the system to access data from their own Internet browser. This will make direct calls to the Department of Public Safety for statewide searches unnecessary. Local agencies will be able to use their own browsers and the relevant case information or agency name, contact, and number will be returned to the inquiring agency. Queries to the FBI's national database will also be possible through the Arizona ViCAP database. Ultimately, ViCAP will provide beneficial information to officers and analysts and will improve the overall effectiveness in which data is collected and analyzed.

Currently, 75 law enforcement agencies have access to a secure web site that will link them to the ViCAP database under development at DPS. Each agency will be able to access a secure network through the Southwest Border Project. Through this network each agency assigned a Southwest Border workstation and is an authorized user will be able to enter, maintain, search, compare and analyze their information. More importantly, the network will allow law enforcement agencies to compare their agency data to information submitted by other law enforcement agencies. The significance and importance of SCAN is that the database will provide a framework that will allow law enforcement agencies to expand investigations. This streamlining of coordination and investigation activities will expedite the identification and prosecution of sex offenders. SCAN will essentially eliminate parallel investigations and will promote a Systematic Multi-Agency Response Team (SMART) approach to crime prevention and apprehension.

Arizona Department of Public Safety (AZDPS)

The Department of Public Safety (DPS), the Arizona Division of Emergency Management (ADEM) and the Arizona Department of Transportation (ADOT) have coordinated their efforts to provide Arizona with a more robust and effective first response system. In order to alleviate problems caused by a lack of reliable data or no data collected

throughout the state, this collaborative unit has put together a grant request for the Environmental Systems Research Institute (ESRI) Homeland Security: Crisis and Response Center Grant Program.

Funding from this grant proposes the creation of a data center with the ability to collect, maintain, and distribute GIS information. The data center would enable agencies to respond to and mitigate future disasters. The grant includes a provision to protect sensitive information while still providing detailed non-sensitive information to the public. The proposal would utilize servers in three locations; one housing all data, one housing non-sensitive data and one containing a mirror image of the main (or collection) server. The server containing all data collected for the state including sensitive information would be housed at ADEM with a mirror image stored at DPS. ADEM would be responsible for providing this spatial information to emergency responders, and providing ADOT with all non-sensitive data that would be available to the public. Public access to the data would be granted through the Internet, thus allowing the public to have immediate access to useful geographic information.

Due to the fact that each of these agencies is charged with providing Homeland Security to the state, the creation of a data center represents a strategic plan designed to effectively respond to a disaster in order to minimize its impact. Much of the data that this collaborative team would like to consolidate already exists in some form or another. Unfortunately, the lack of one format, the timeliness of this information, and different computer languages causes a lack of uniformity and accessibly in the event of an emergency. The proposed new GIS data center will allow for increased accessibility, promote data sharing, require federal metadata standards to be followed and allow the GIS community in Arizona to obtain needed data layers during emergencies in near real time.

Arizona State Cartographer's Office

The State Cartographer's Office (SCO) was established by Arizona State statute in 1988 and was funded by the Arizona State Land Department in 1995. The State Cartographer's Office is responsible for developing and managing long-term programs for collecting, updating, and disseminating statewide information about Geographic Information Systems (GIS) in Arizona. The main duties of SCO are to facilitate the development and maintenance of GIS data, including the examination of legal issues related to the access, cost recovery, and sharing of data. This involves the development of GIS standards, coordinating multi-agency projects, and obtaining funding sources which improve the development, use and access of GIS data in Arizona. Currently, the SCO conducts projects that develop statewide data, information or applications. The focus of most SCO projects is on framework data such as transportation, elevation, imagery, geodetic control, or boundaries. Framework data gives context to other, more specific data and can be useful for public safety, health, welfare and Homeland Security.

The SCO is currently conducting several projects that include the following:

- The Arizona State Cartographer's Office (SCO) in cooperation with project partners is making available a set of statewide Digital Orthophoto Quadrangles (DOQs). A DOQ is a digital image of an aerial photograph in which image displacement and distortion, caused by terrain relief and camera tilt, has been removed. A DOQ is a spatially accurate image with features represented in their true geographic positions, so it combines the image characteristics of a photograph with the geometric qualities of a map. The SCO is also working to establish a GIS Portal in an effort to create a geospatial data repository for Arizona. The GIS Portal is intended to serve as a gateway to GIS data, and will allow individuals access to a variety of geographic information sources via the World Wide Web. The Portal's initial design will be modeled after the Kansas Portal, with the main objective being the dissemination of data and information. Additionally, the SCO has established projection, data formats, and metadata standards for State GIS databases in Arizona.

- The SCO, through the Arizona Geographic Information Council (AGIC), is also working with the Federal Geographic Data Committee (FGDC) to develop data content standards for geospatial data. The SCO is involved in this project because it will lead to a more efficient set of data standards which will allow GIS data to be shared between different agencies. Unless there is a compelling reason that suggests it is not in the best interest of the state, Arizona will adopt the federal geospatial standards.

- Finally, the SCO is collaborating with the Arizona Geographic Information Council (AGIC), the Government Information Technology Council (GITA), Homeland Security Committee and several State agencies to develop a Homeland Security plan which focuses on GIS and Critical Infrastructure Security. Timely, accurate information that is easily accessed and shared across federal, state and local jurisdictions is fundamental to the decision-making capability of those tasked with protecting life and property. Without the real-time ability to quickly map locations, visualize activity patterns, and understand the multi-layered geographic context of emergency situations, management and response capabilities are severely hampered.

SPECIAL INVESTIGATION

Although the study of a regional analysis center was not within the original scope of this project, it was included based upon initial feedback from the ACJC Crime Mapping Survey and Arizona crime mapping analysts. The information gathered from the special investigation provides an initial assessment to the issues germane to the development and implementation of a regional analysis center. Additionally, issues relative to establishing a regional analysis center in Arizona are summarized and included as part of this analysis.

ARIZONA REGIONAL ANALYSIS CENTER

The success of the previously mentioned regional analysis centers has sparked interest in developing a regional analysis center in Arizona. As the importance of mapping across jurisdictions becomes more apparent, criminal justice agencies throughout the state are recognizing the need to establish this technology in Arizona. In April 2002, the Arizona Criminal Justice Commission (ACJC) sponsored two crime courses, an introductory course as well as an advanced, for crime analysts in the state. From this training and informal discussions with the Arizona Association of Crime Analysts, a committee emerged to address issues related to the development of a regional analysis center in Maricopa County. Based upon these meetings and the research of other regional analysis throughout the nation, several issues pertinent to establishing a regional analysis center were identified.

Identification of Stakeholders

One of the first and most important factors related to developing a regional analysis center is the identification of key stakeholders. Before proceeding with the implementation of a regional analysis center, key individuals, agencies, and organizations must be identified because obtaining their support, cooperation, and participation in the project is critical to the overall success. This also means obtaining the support of the decision-makers.

Scope

After identifying the key stakeholders, the scope of the regional analysis center must be determined. Geographic locations are organized differently (e.g. counties, districts, etc.) and as such it is important to determine which areas will be included in the regional analysis center. In Arizona, counties represent possible options for regional analysis centers because of the data that currently exists at this level. A second consideration relative to scope pertains to the types of agencies that will contribute data to the regional analysis center (i.e. law enforcement, probation, county attorneys, courts, etc.). Because issues pertaining to the security of shared data are essential to a regional analysis center, it is recommended that the original scope of the center be limited to law enforcement agencies.

Data

After identifying and soliciting the participation of key stakeholders, the types of data that will be available through the regional analysis center should be considered. Ideally, an assessment of the information (data) currently collected by criminal justice agencies should be determined. In addition to identifying the types of data collected in Arizona, the reliability and validity of the data collected should also be determined because the usefulness of a regional data system depends on a consistent and uniform method of collecting information (Bibel, 2002). Further, because the utility of the data collected extends to the accuracy of data entry, it is imperative that the individuals responsible for data entry recognize that the accuracy of their data is essential not only to their jurisdiction, but to the coordinated efforts of the regional analysis center. The accuracy of the data entry process can be improved through technology (address cleaning software) and proper training (CMAP, 2002). Finally, the development of a regional analysis center may also require a Memorandum of Understanding between participating agencies regarding data sharing, information usage, timely submittal of data, and how privacy protections will be safeguarded (Institute for Law and Justice, 2001).

In order for data to have mapping capabilities, a determination should be made as to whether this information contains addresses or geographic coordinates. Adding address information and/or geographic coordinates enhances the crime mapping capabilities extensively and allows for better coordinated crime prevention strategies. However, if this information is not included in the crime data collected, the necessary steps should be taken to geocode this information and standards should be established that would include this information in future data collected. A final component of effective data collection and utilization is the standardization of metadata. Metadata, or "data about data," is information specific to a dataset that makes information comprehendible and usable to users over time (Block & Canter, 2002). Metadata information includes data quality measures, identification information, and reference information.

Data Transfer

After addressing the issues related to data collection, utilization, and maintenance, the next component of a regional analysis center is the identification of a single infrastructure that allows for the transfer of information from disparate Record Management Systems. Based on a series of discussions with crime analysts and experts in the field of crime mapping and geographic information systems, several options emerged as potential methods of transferring data to a regional analysis center. A Virtual Private Network (VPN) could be established that would provide the necessary security for the sharing of sensitive crime data between criminal justice agencies. Additional options would entail the use of existing infrastructure and/or data extracts currently being used by other criminal justice information systems. There is a basic discussion regarding these options later in this section.

Location and Governance

Another important component of a regional analysis center is where to store the data. Beyond the physical location of the data, it is important to know exactly how the system and information within the regional analysis center will be governed. Given the nature of the information contained within the system, MOUs and other formal agreements will need to be arranged. These agreements and understandings should detail how data will be distributed as well as specify access authority levels for individual users and agencies to the system. The question as to whether there will be a governance committee or a single entity in charge of the operation of the regional analysis center should also be answered.

Resources

Once a plan for implementing a regional analysis center in Arizona has been established and agreed upon it is critical that resources to support this project are made available. It is important to recognize that the project design and implementation plan can greatly influence the overall cost and resources necessary for such a project. Most criminal justice agencies are required to report to numerous outside entities at the federal, state, and local levels; therefore, considerable resources are often dedicated to the development and maintenance of these data extracts within their department. Currently, there are numerous funding and grant opportunities related to the enhancement of geographic information systems and data sharing through a regional analysis center. Many of the funding opportunities are contingent upon the state developing a strategic plan for this process. Because of this, Arizona has been working to develop such a plan through the Governor's Office and the State Cartographer's Office.

MARICOPA REGIONAL ANALYSIS CENTER

The previously mentioned committee that was established to discuss the development of a regional analysis center not only identified general issues related to the development of a regional data sharing system, but identified issues specific to establishing a regional analysis center in Maricopa County. Based upon feedback from several committee meetings, a variety of potential strategies were identified for consideration. Because the identification of key stakeholders is crucial to establishing a regional analysis center, the committee noted that the key stakeholders in Maricopa County included but are not limited to: the Arizona Association of Crime Analysts, the Arizona Department of Public Safety, the Arizona State Cartographer's Office, the Arizona Geographic Information Council, the Phoenix Police Department, the Glendale Police Department, the Tempe Police Department, the Scottsdale Police Department, the Maricopa County Sheriff's Office, the Phoenix Fire Department, the Mesa Police Department, and the Crime Mapping & Analysis Program. Additionally, the Arizona Chiefs of Police and the Arizona Criminal Justice Commission have been identified as key decision makers for this process.

In Arizona, the primary data collection methods include: Uniform Crime Reports (UCR), National Incident Based Reporting System (NIBRS), and the Violent Crime Apprehension Program (ViCAP). Currently, Uniform Crime Reports have the largest law enforcement participation in Arizona, however there are limitations regarding the level of detail that this information provides. Specifically, UCR data captures only the most serious offense within an arrest or incident. While UCR data represents a data collection method widely used by law enforcement agencies in Arizona, the limitations of this data collection would also limit the effectiveness of the data in a regional analysis center.

The National-Incident-Based Reporting System is the newest crime data collection method advocated by the Federal Bureau of Investigations. NIBRS collects information on each crime incident and is designed to enhance the overall value and efficiency in which the law enforcement community collects crime data. In contrast to Uniform Crime Reporting (UCR), NIBRS extends its data collection beyond the 8 Part I Crimes to 53 specific offenses that occur within a law enforcement jurisdiction. More importantly, "since data is collected on the crime incident, analyses and maps can be produced showing rates or volumes of victimization by race, gender, age or differing levels of property stolen" (Bibel, 2002).

Currently, only three law enforcement agencies in Arizona are in the process of implementing the NIBRS data collection method. While NIBRS represents a more efficient data collection method, its limited use among law enforcement agencies in Arizona is a significant limitation of using this data in a regional analysis center. When considering NIBRS as a possible data source for a regional analysis center, considerations must also be given to the effort required to solicit law enforcement agencies to participate in the data collection method.

Established in 1985, ViCAP is a nationwide data information center that collects, collates, and analyzes crimes of violence-specifically murder. The mission of ViCAP is to facilitate cooperation, communication, and coordination between law enforcement agencies and provide support in their efforts to investigate, identify, track, apprehend, and prosecute violent serial offenders. Cases that are examined by ViCAP include solved or unsolved homicides or attempts, especially those that involve abduction and that are apparently random, motiveless, sexually oriented or are known or suspected to be part of a series. Also, missing persons are examined where the circumstances indicate a strong possibility of foul play and the victim is still missing and they help with identifying dead bodies where the manner of death is known or suspected to be a homicide.

In Arizona, approximately 75 law enforcement agencies participate in the ViCAP program. The collection is limited to violent crime and therefore is not as comprehensive as the NIBRS data collection system. However, there are a greater number of law enforcement agencies that participate in this program. Because of this, the ViCAP data collection method merits consideration when discussing the development of a regional analysis center in Maricopa County.

In addition to identifying an appropriate and effective data source, issues related to connectivity between participating agencies is also important. In Arizona, COPLINK is one example of the interagency connectivity that is possible between law enforcement agencies. COPLINK Connect collects data from non-linked computer systems within a single agency or among different participating agencies across jurisdictional lines. COPLINK Detect, sifts through the vast array of information and connects the clues to identify suspect's vehicles and weapons. This system was developed in Tucson and allows participating police departments to rapidly share and analyze crime data across jurisdictions. COPLINK allows investigators to access a wide variety of sources to link suspects to crimes and apprehend them. The system developed as a cooperative effort between the University of Arizona and the Tucson Police Department. The system is divided into two major products: (1) COPLINK Connect and (2) COPLINK Detect. Within the past year the COPLINK system was replicated at the Phoenix Police Department. Additional sites in Maricopa County are being considered for future COPLINK implementation.

As noted previously, the State Cartographer's Office is working with several partners to develop a Homeland Security Plan and a Critical Infrastructure Support Center. The Critical Infrastructure Support Center will support a statewide framework system that will better integrate state, local and federal geospatial data. There have been some initial discussions that suggest that this project could also serve to house and support a regional analysis center within Arizona.

Through our review of regional analysis centers throughout the country, it was found that many areas are using the High Intensity Drug Trafficking Area (HIDTA) Program to satisfy this role. The Anti-Drug Abuse Act of 1988 created the HIDTA Program. This act authorized the Director of the Office of National Drug Control Policy (ONDCP) to designate regions within the United States that face drug trafficking threats affecting other areas of the nation as HIDTAs. The mission of HIDTA is to enhance and coordinate America's drug control efforts among federal, state and local regions in order to eliminate or reduce drug trafficking. The HIDTA Program provides resources to assist each HIDTA in developing and implementing a strategy to address its regional drug threat.

It is important to note that the options discussed above were presented as considerations for a regional analysis center in Maricopa. While each option brings specific advantages forth regarding a regional analysis center, the limitations of each option must also be thoroughly considered. Specifically, it is critical that a formal process for assessing all options be developed and agreed upon prior to moving forward with the concept of a regional analysis center. Additionally, much of this discussion is relevant to the development of a regional analysis center in other areas in Arizona.

RECOMMENDATIONS

In addition to evaluating the current status of crime mapping in Arizona, an important part of this research included the identification of recommendations designed to facilitate the continued progress of crime mapping in Arizona. Through this evaluation, a better understanding of mapping within Arizona criminal justice agencies was achieved. Based upon this enhanced understanding, the following recommendations are offered:

More Resources

There is a consistent message from criminal justice agencies both from a national and local perspective that more resources need to be directed toward pursing spatial analysis. Resources refer to both money and training for the advancement of crime mapping at the local level.

Statewide Standards

In order eliminate redundancy and assure efficient exchange of data for spatial analysis, it is critical that standards regarding geographic information be developed and put in place. The State Cartographer's Office, through the Arizona Geographical Information Council (AGIC) and the Government Information Technology Council (GITA), has been working with the Federal Geographic Data Committee (FGDC) on the development of data content standards for geospatial data.

Strategic Plan

In order to assure that efforts for the sharing of geospatial data are coordinated, it is critical that a Strategic Plan for this purpose be developed and put in place. Through the development of a Strategic Plan, Arizona is in a position to quickly move forward should funding opportunities become available. The State Cartographer's Office has been working with the AGIC Homeland Security Committee and several state agencies to develop a Homeland Security plan which focuses on GIS and Critical Infrastructure Security.

Data Quality

One of the major issues associated with successful crime mapping is the availability of geocodable addresses. A major factor contributing to this process is the availability of accurate addresses. Therefore, local jurisdictions should be encouraged to develop and implement policies and processes that guarantee the quality of data (addresses) put into their Records Management System. Specifically, set and recommend standards for data quality at local/agency level.

Regional Analysis Center Committee

Selection of a committee to help evaluate options and make recommendations for creating a regional analysis center in Arizona. This committee would report and receive direction from the Arizona Chiefs of Police and the Arizona Criminal Justice Commission.

Regional Analysis Center

There has been considerable documentation regarding the advantages of a regional analysis center within an urban setting. As a result, there has been discussion in Maricopa County which suggests great interest in moving forward with the project. Initially, a pilot project should be selected and implemented in one or more urban settings based upon recommendations from the Regional Analysis Center Committee.

The above recommendations were developed as a result of the evaluation conducted by the Arizona Statistical Analysis Center pertaining to crime mapping. It is hoped that the above recommendations will assist policy and decision makers in setting the direction to further the crime mapping and geospatial data sharing projects in Arizona.

CONCLUSIONS

Although the use of geographic information systems has had widespread use for managing geographic and spatial data for decades, this technology has only recently begun to emerge within the criminal justice community. The tragic events of September 11, 2001, not only confirmed the need for coordination between agencies and integrated data sharing, this event also demonstrated a need to obtain and maintain accurate spatial information on local, state and federal levels. Effective crime mapping systems depend upon accurate and timely information from both criminal justice and non-criminal justice agencies; as such, acquiring data reflective of various community components is essential to developing effective prevention, investigation, emergency response and planning initiatives (Helms, 2002).

Currently, there are several statewide projects in Arizona attempting to coordinate the development and maintenance of critical data sources. The Arizona State Cartographer's Office (SCO) is working in collaboration with the Arizona Geographic Information Council (AGIC) to develop and implement standards related to sharing spatial data. Once completed, these standards will contribute greatly to the sharing of spatial data and allow for future funding opportunities for enhancement of geographic information systems within Arizona.

National trends toward crime prevention strategies seek to develop community profiles through the assessment of information from disparate systems. The Regional Crime Prevention Strategy within the Maricopa Juvenile Court Center is a pilot project seeking to develop community profiles for resource allocation and decision making. Chief Jim Bueerman, a national leader in law enforcement crime mapping from the City of Redlands Police Department suggests "that police departments create community analysis units in which all types of information are combined and analyzed to examine community problems." (Bueerman, Crime Mapping News, 2000).

The sharing of data across jurisdictional boundaries within law enforcement and criminal justice agencies are on the rise. These projects have been referred to as regional analysis centers or Cross Boundary Crime Mapping Systems (Eck, 2002). The feasibility of such projects has only become available due to recent technological advances that have made crime mapping less cost prohibitive. One of the major barriers for such a project is the complexity of data integration across boundaries that may be protected by political and/or bureaucratic constraints. Therefore, in order to proceed there must be "buy-in" by agencies at the highest level before deciding to move forward.

Arizona has shown an increasing interest in the potential for crime analysis through crime mapping technology. Most criminal justice agencies in Arizona are interested in developing better systems for analyzing data through spatial data. However, only a

small number (14.5 percent) of criminal justice agencies currently use this technology. Commonly cited barriers by criminal justice agencies in Arizona as well as nationally are the lack dollars and training necessary to move forward. Local criminal justice agencies also noted that there are considerable training costs associated with the implementation of a geographic information system for the purpose of crime mapping. It is critical to the development of crime mapping within Arizona that training opportunities are made available to both new and ongoing crime mapping projects.

Within the foreseeable future, crime mapping technology will become an indispensable tool for both law enforcement and criminal justice agencies. It is clear that criminal justice and community leaders recognize the potential for developing a system that provides for the sharing and analyzing of spatial data. Due to the complexity of coordinating and implementing such a project, it is critical that strong support from key stakeholders and decision makers never waiver in regard to enhancement of geographic information system projects within Arizona.

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ARIZONA CRIMINAL JUSTICE COMMISSION

2002 Survey

Our mission is to sustain and enhance the coordination, cohesiveness, productivity, and effectiveness of the Criminal Justice System in Arizona.

Arizona Criminal Justice Commission

Crime Mapping Technology Survey

AGENCY INFORMATION

AGENCY TYPE: (Check Appropriate Box)

☐ Law Enforcement
☐ Courts
☐ Attorney
☐ Other(*Specify*)_____

AGENCY LEVEL: (Check Appropriate Box)

☐ Federal
☐ Municipal
☐ State
☐ Tribal
☐ County
☐ Other (*Specify*)_____

AGENCY NAME: _____

CONTACT NAME: _____ **TITLE:** _____

PHONE: _____ **EMAIL:** _____

1a. Does your department use the Internet (Email or World Wide Web)?
☐ Yes ☐ No (If No, Skip to Question 2a)

b. Does your agency have an active web site?
☐ Yes ☐ No

c. If yes, (question 1b) does the web site have links to crime maps?
☐ Yes ☐ No

d. How likely is it that you, or your agency, would subscribe to a listserv (i.e. electronic bulletin board) about computerized crime mapping? (Circle appropriate number)

1	2	3	4	5
Not Very Likely				Very Likely

2a. Does your agency have computerized crime report information available?
☐ Yes ☐ No

b. If yes (question 2a), what type of information can your agency access via computer?

CAD- Computer Aided Dispatch Records ☐ Yes ☐ No

RMS- Records Management Data for Reported Crimes ☐ Yes ☐ No

RMS- Records Management Data for Criminal Persons ☐ Yes ☐ No

3. Does your agency have a Crime Analysis Unit assigned to analyze data collected by your agency?
☐ Yes ☐ No

4. Which types of crime analysis does your agency currently perform? (Check all that apply)

☐ Point Pattern Analysis	☐ Case Studies	☐ Linkage Analysis
☐ Pin Maps	☐ Pattern Detection	☐ Trend Analysis
☐ Statistical Reports	☐ Strategic Analysis	☐ UCR Reports
☐ Case Management	☐ Series Analysis	☐ Other(*Specify*)_____

5a. Does your agency currently perform any computerized crime mapping?
☐ Yes ☐ No (If No, Skip to Question 27)

b. If yes (question 5a), who performs the computerized crime mapping queries?(Check all that apply)
☐ Crime Analysis Staff ☐ Patrol Officers ☐ Investigations Staff
☐ Dispatch Staff ☐ Other (*Specify*) _____

6. What percent of staff in each of the above marked categories perform computerized crime mapping queries?

Crime Analysis	Patrol Officers	Investigations	Dispatch	Other
%	%	%	%	%

7. How long has your agency been performing computerized crime mapping?

_____#of Years _____# of Months

8. Does the crime data used by your agency contain a geographic reference (e.g. incident address, beat or zip code)? ☐ Yes ☐ No

9. Does your department use a commercially available software package for crime mapping?
☐ Yes ☐ No

10. If yes (question 9), which software packages do you use? (Check all that apply).

☐ ArcInfo	☐ ArcView	☐ Atlas GIS	☐ IDRISI
☐ Intergraph	☐ Mapexpert	☐ MapInfo	☐ Maptitude
☐ Crime View	☐ Map Objects	☐ Streets on a Disk	
☐ ARC IMS		☐ Other (*Specify*) _____	

11. What version of the above software does your unit predominately use in crime mapping (e.g. Arc View, Version 2.1)?

_____Software _____Version

12. What type of data does your department geocode or map? (Check all that apply)

☐ Adult Offenders	☐ Gang Related Crime (membership involvement)
☐ Juvenile Offenders	☐ Vehicle Recovery
☐ Probationers	☐ Property Recovery
☐ Prison Releases	☐ Offense Data
☐ Field Intelligence Reports	☐ Gang Related Crime (gang motivated)
☐ UCR Reported Crimes	☐ A.R.S. Reported Crimes
☐ Traffic Collisions	☐ Traffic Citations
☐ Registered Sex Offenders	☐ Field Intelligence Reports
☐ Parolee Locations	☐ Probation Locations
☐ Calls for Service	☐ Other (Specify) _____

13. Which types of crimes does your agency map? (Check all that apply)

☐ Robbery	☐ Homicide	☐ Rape	☐ Aggravated Assault
☐ Common Assault	☐ Burglary	☐ Larceny/Theft	☐ Disorderly Conduct
☐ Vehicle Theft	☐ Arson	☐ Gangs	☐ Weapons Violations
☐ Drug Offenses	☐ Traffic Offenses	☐ Forgery/Fraud	☐ Domestic Violence
☐ Gambling	☐ Kidnapping	☐ Prostitution	☐ Firearm Discharges
☐ DUI/DWI	☐ Other Sex Offenses		☐ Vandalism/Destruction
☐ Other (Specify) _____			

14. What types of computerized crime mapping analyses does the department perform? (Check all that apply)

☐ Automated Pin Maps	☐ Trend Analysis	☐ Temporal Analysis
☐ Offender Movement	☐ Pattern Analysis	☐ Situational Analysis
☐ Density/Hotspots	☐ Series Analysis	☐ Other (*Specify*) _____

15. How often does the department conduct crime mapping analysis? (Check all that apply)

☐ Daily	☐ Weekly	☐ Bi-Weekly
☐ Monthly	☐ As Needed	☐ Other (*Specify*) _____

16a. Does your agency conduct crime cluster or hot spot analysis?
☐ Yes ☐ No (If No, Skip to Question 19)

b. If yes (question 16a), indicate which crime cluster or hot spot analysis methods are used by your agency? (Check all that apply)

☐ Visual Identification of Hot Spots
☐ Computer Program Identification of Hot Spots (e.g. STAC) (*Specify*)_____
☐ Other (*Specify*) _____

17. How does your agency use the results produced by crime mapping analysis? (Check all that apply)

☐ Inform Patrol Officers/Investigators
☐ Apply/Evaluate Specific Interventions
☐ Identify Locations w/ Repeat Calls for Service
☐ Provide Information to Command/Executive Staff
☐ Provide Information to City/County Management
☐ Other (*Specify)* _____
☐ Assist Dispatchers
☐ Inform Community
☐ Redistricting (e.g. beats)
☐ Other Administrative Decisions
☐ Assist Resource Allocation Decisions

18. Does your agency or crime analysis unit perform all three levels of crime analysis and what percentage of time is devoted to each type?

Administrative (long-term, city-wide, data reporting)	☐ Yes	☐ No	____%Time
Strategic (hot spot mapping)	☐ Yes	☐ No	____% Time
Tactical (problem-oriented policing)	☐ Yes	☐ No	____%Time

19. What is the source of the street map your agency uses for crime mapping? (Check all that apply)

☐ Commercial Vender (*Specify*) _____
☐ Government Agency (*Specify*) _____
☐ Develop Mapfiles in House
Amount of Hours to Develop Mapfiles _____
Amount of Dollars to Develop Mapfiles _____
☐ Other (*Specify*) _____

20. Which of the following best describes the reference files that your agency uses for gecoding and crime mapping? (Check all that apply)

☐ Street Centerlines ☐ Parcel Database ☐ Other (Specify) _____

21. Are the street maps used by your agency edited for accuracy and detail? (Check all that apply)

☐ Maps Not Edited
☐ Address Verification Function in Dispatch System
☐ Address Verification Function in Records Management System
☐ Extensive Edits
☐ Other (*Specify*) _____

22. How often are your agency's street maps (base maps) updated? (Check all that apply)

☐ Monthly ☐ Quarterly ☐ Yearly
☐ No Updates ☐ Other (Specify) _____

23. Have agency members received any training in computerized crime mapping techniques?
☐ Yes ☐ No

24. How would you characterize the training of agency members who do computerized crime mapping? (Check all that apply)

- ☐ Self-Taught
- ☐ Informal Instruction by Colleague
- ☐ Vendor Supplied Instruction
- ☐ Department Training
- ☐ University/College Course
- ☐ Correspondence/Distance Course
- ☐ Contractor Supplied Instruction
- ☐ Other (*Specify*) _____

25a. Do you have GIS-trained personnel assigned to the function of updating your reference files?
☐ Yes ☐ No

b. If yes (question 25a), where are the trained personnel located within your agency?
☐ Crime Analysis Unit ☐ Computer Services ☐ City IT Department
☐ County IT Department ☐ Other (*Specify*) _____

26. Can members of your Crime Analysis Unit train other people in any of the following categories? (Check all that apply)

- ☐ Crime Analysis Basic
- ☐ Computer Crime Mapping
- ☐ Advanced Crime Mapping
- ☐ Crime Stat
- ☐ SPSS
- ☐ SQL
- ☐ Advanced Crime Analysis
- ☐ Database Design
- ☐ Access, Excel or Word
- ☐ Visual Basic
- ☐ Oracle
- ☐ Database Construction, Forms, Queries, Reports

27a. If a week long certified course in crime analysis/crime activity was offered in Arizona at one location, would you attend? ☐ Yes ☐ No

b. Rate your likelihood of attending the certified course below.

1	2	3	4	5
Not Very Likely				Very Likely

28a. A certificate of completion program in Crime and Intelligence Analysis was recently developed to train people in the fundamentals of analysis work. Are you familiar with the program?
☐ Yes ☐ No

b. Would you or others in your agency be interested in receiving additional information on the certification program? ☐ Yes ☐ No

c. How likely would you be to attend this program if the courses were offered in the Phoenix metro area?

1	2	3	4	5
Not Very Likely				Very Likely

d. How likely would you be to attend this program if the courses were offered on line?

1	2	3	4	5
Not Very Likely				Very Likely

29. If you are not currently using GIS in your agency, what is the most predominant reason why your agency does not use this technology?

☐ Unavailability of Money
☐ Unavailability of Qualified Personnel
☐ Unavailability of Administrative Support Staff
☐ Other (*Specify*) _____
☐ Unavailability of Training
☐ Unavailability of Hardware/Software
☐ Technology Will Not Assist Agency

30. If there was a state repository for criminal GIS information, would your agency be willing to contribute data?

☐ Yes ☐ No

31. Rate the skill of the individual with highest level of expertise of crime mapping skills within your agency.

1	2	3	4	5
Not Very Proficient				Very Proficient

32a. Are you or are others in your agency currently members of the Arizona Association of Crime Analysts (AACA)? ☐ Yes ☐ No ☐ Unable to Determine

b. If not, would you be interested in receiving additional information on the state association (AACA)?

☐ Yes ☐ No

33. Please use the following section to provide suggestions/feedback as it would relate to Crime Mapping in Arizona.

_____
_____
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34. Additionally, please include any information regarding references to articles published regarding Crime Mapping in Arizona, appropriate websites, and/or examples of innovative Crime Mapping within the state.

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APPENDIX B: Criminal Justice Agency Websites

Chandler Police Department
http://www.chandlerpd.com/

Cochise Juvenile Court
http://www.apltwo.ct.state.az.us/cochise/juvenile.htm

Coolidge Police Department
http://www.azpolicejobs.com/coolidge.htm

Douglas Police Department
http://police.ci.douglas.az.us/default.asp

Gilbert Police Department
www.ci.gilbert.az.us

Glendale Police Department
http://www.ci.glendale.az.us/Police/Glendale-Police-Crime-Analysis-Unit.cfm

Goodyear Police Department
http://www.ci.goodyear.az.us/new/html/publicsafety/police/

Maricopa County Juvenile Probation
http://www.superiorcourt.maricopa.gov/juvenileProb/programs/programs.asp

Maricopa County Sheriff's Office
http://www.mcso.org/index.asp

Mesa Police Department
http://www.ci.mesa.az.us/police/crime_analysis/default.htm
link to crime maps:
http://www.ci.mesa.az.us/police/crime_analysis/patrol.htm

Oro Valley Police Department
http://www.ovpd.org/

Peoria Police Department
http://www.peoriaaz.com/PoliceDept/index.htm

Phoenix Police Department
http://www.ci.phoenix.az.us/POLICE/crista1.html

Pima County Attorney
http://www.pcao.co.pima.az.us/index.shtml

Pima County Sheriff
http://www.pimasheriff.org/

Prescott Police Department

http://police.cityofprescott.net/

Scottsdale Police Department
http://www.ci.scottsdale.az.us/police/CAU/cauindex.asp
link to crime maps:
http://www.ci.scottsdale.az.us/police/CAU/Crime_data_by_beat.asp

Superior Police Department
http://www.pcpages.com/superiorpd/

Tucson Airport Authority
http://www.tucsonairport.org/taa/taa_index.html

Winslow Police Department
http://www.winslowarizona.com/police.html

APPENDIX C: Regional Analysis Centers

Delaware Real Time Crime Reporting (RTCR)

Delaware implemented a statewide crime mapping system in January of 2000 that allowed every state, county, and municipal police agency in Delaware to map and analyze state crime data. The vision for this project began as a challenge by Governor Thomas Carper in 1998. Governor Carper sought to establish a statewide "crime tracking system" that immediately mapped and traced crimes so that all police departments statewide were provided with crime data on a real time basis. From this challenge, Delaware law enforcement conducted a preliminary needs assessment that paved the way for the passage of Senate Bill 411 in June 1998. This bill provided $3 million in grant funding towards the development and implementation of the Real Time Crime Reporting (RTCR) project.

Under RTCR, law enforcement officers through an automated application called Enhanced Police Complaints (EPC) on Mobile Data Computers enter data. This information is transmitted to the central repository, Delaware Justice Information System (DELJIS), through a cellular digital package using wireless technology. The information is then sent to the Real Time Crime Reporting (RTCR), and is immediately geocoded and stored within an Oracle database. The application is Web-based and uses Visual Basic, Intergraph GeoMedia Web Map, Web Map Enterprise, and Microsoft Visual InterDev with crime data being distributed through a statewide Intranet system.

Orange County Regional Analysis Center (GITS)

The planning and development of the Gang Incident Tracking System (GITS) began in 1992 and took approximately 6 months to complete. In 1993, the system officially went online, and all participating agencies were able to secure access to the system within a year. Through the collaborative efforts of law enforcement agencies, schools and businesses in the Orange County area, the Orange County Gang Incident Tracking System (GITS) was created as a response to increasing gang activity in the area. GITS was established to provide information about gang trends that could be used to develop strategic gang reduction plans.

There is no special hardware used for GITS or the associated mapping and analysis beyond the requirements for Microsoft Office and ESRI Software Packages. All software is run on standard desktop computers. GITS was developed and continues to operate through a Microsoft Access database. The database includes tables for each year of GITS data, forms and reports. In addition to the database, GITS researchers also use ArcView GIS and Spatial Analyst packages, SPSS, Microsoft Excel and PowerPoint. Information contained within GITS includes gang related incidents involving violent crimes, vandalism (graffiti), weapon violations, property crimes and narcotic sales.

San Diego Regional Analysis Center

The Automated Regional Justice Information System (ARJIS) is a complex criminal justice network used by 38 local, state and federal agencies throughout the San Diego region. Created in the 1970s, ARJIS provides county law enforcement agencies with the ability to maintain and access accurate crime and arrest data. ARJIS also assists law enforcement agencies in tactical analysis, investigations, obtaining statistical information and crime analysis. ARJIS is structured so that all participating agencies use the same reports for crime cases, arrests, citations, field interviews, traffic accidents and property incidents (Mapping Across Boundaries, 2001). The structure and design of ARJIS also allows officers and investigators to request an electronic notification when another agency or officer concerning an individual, location or vehicle obtains information. The overall success of ARJIS is attributed to the "single point of entry" to query all regional justice data.

ARJISNet integrates approximately 2,500 workstations and printers throughout the 4,300 square miles of San Diego County. Currently, there are more than 10,000 users generating over 35,000 transactions daily. The ARJISNet provides regional information through a secure Intranet on arrests, citations, crime cases, field interviews, fraudulent documents, gang information, photographs, traffic accidents and stolen property.

Virginia Regional Analysis Crime Program (RCAP)

The Virginia Regional Analysis Crime Program was a joint project involving three law enforcement agencies within central Virginia: the Albemarle County Police Department, the Charlottesville Police Department, and the University of Virginia Police Department. Prior to the start of this project there was nothing in the way of an automated mapping system and a limited Recorded Management System within these police departments. Therefore, the scope of this project involved the development of an infrastructure that would support data sharing and analysis on a regional basis. The project began in 1995 and took approximately two years to fully develop and implement the Regional Analysis Crime Program.

Initially, the system was employed a Fox Pro database with the ReCAP used as a front end interface into MapInfo. Later, the database was converted to a Microsoft Access database and uses a Microsoft SQL server. Additionally, the MapInfo system was converted to ESRI products with ARC View and Map Objects using Map X programming. Prior to the development of a central server, the project faced the challenges of receiving the data electronically, and often, duplicate data-entry was required. Fortunately, a grant provided for the development of a records management system at each agency and allowed for online data sharing.

The ReCAP system allows for cross jurisdictional mapping and analysis among local law enforcement agencies. The advanced regional system allows crime analysts and researchers to track changes in crime through both temporal and spatial analysis. One of the challenges continuing to face the project is the need for accurate address information in order to map the crime incidents. At present, approximately 70 percent of the crime incidents accurate addresses and are geocoded for further analysis with the ReCAP system.

APPENDIX D: Arizona Association of Crime Analysts

Agency	Address	City	Zip
Apache Junction Police Department	1001 N. Idaho Rd.	Apache Junction	85219
ASU Department of Public Safety	PO Box 870804	Tempe	85287
Avondale Police Department	519 E. Western Ave.	Avondale	85323
Buckeye Police Department	100 N. Apache Rd.	Buckeye	85326
Chandler Police Department	250 E. Commonwealth Ave.	Chandler	85225
AZ Department of Public Safety	PO Box 6638	Phoenix	85005
Gang Intelligence and Team Enforcement Mission	2828 N. Central Ave. Suite #1060	Phoenix	85004
El Mirage Police Department	14406 N. Primrose St.	El Mirage	85335
Federal Bureau of Investigations	201 E. Indianola Ave. Suite #401	Phoenix	85012
Fountain Hills Police Department	16838 E. Palisades Blvd., Bldg. B	Fountain Hills	85269
Gilbert Police Department	1025 S. Gilbert Rd.	Gilbert	85296
Glendale Police Department	6835 N. 57th Dr.	Glendale	85301
Goodyear Police Department	119 N. Litchfield Rd.	Goodyear	85338
Maricopa County Adult Probation Department	111 S. 3rd Ave, Third Floor	Phoenix	85003
Maricopa County Sheriff's Office	102 W. Missouri St	Phoenix	85003
Mesa Community College Public Safety	1833 W. Southern Ave.	Mesa	85202
Mesa Police Department	130 N. Robson	Mesa	85201
Paradise Valley Police Department	6433 E. Lincoln Dr.	Paradise Valley	85253
Peoria Police Department	PO Box 340	Peoria	85380
Phoenix Police Department	620 W. Washington St.	Phoenix	85003
Prescott Police Department	222 S. Marina Street	Prescott	86303
Rocky Mountain Information Network	2828 N. Central Ave.	Phoenix	85004
Scottsdale Police Department	9065 E. Via Linda	Scottsdale	85258
Surprise Police Department	12425 W. Bell Rd.	Surprise	85374
Tempe Police Department	120 E. 5th St.	Tempe	85281
Tolleson Police Department	9555 W. Van Buren St.	Tolleson	85353
Youngtown Police Department	12038 Clubhouse Square	Youngtown	85363
Yuma Police Department	1500 S. 1st St.	Yuma	85364